

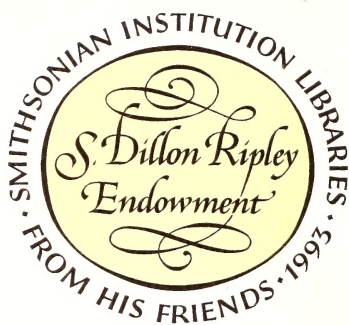


WWF

TRACKING TIGERS:

A Review of the Status of Tiger, Asian Elephant, Gaur and Banteng in Vietnam, Lao, Cambodia and Yunnan (China), with Recommendations for Future Conservation Action

J. W. DUCKWORTH and S. HEDGES



TRACKING TIGERS:

A REVIEW OF THE STATUS OF TIGER, ASIAN ELEPHANT, GAUR AND BANTENG IN VIETNAM, LAO, CAMBODIA AND YUNNAN PROVINCE (CHINA), WITH RECOMMENDATIONS FOR FUTURE CONSERVATION ACTION

Compiled by

J. W. DUCKWORTH, consultant to WWF Indochina

and

S. HEDGES, co-chair, IUCN/SSC Asian Wild Cattle Specialist Group

WWF Indochina Programme,

Hanoi,

August 1998

QL
706.83
I48D82
1998
NZP

- Published by: WWF Indochina Programme, Hanoi, Vietnam
- Reproduction: Reproduction of material from this document for education or other non-commercial purposes is authorised without the prior permission of WWF Indochina Programme, provided the source is acknowledged.
- Citation: Duckworth, J. W. and Hedges, S. 1998. *A review of the status of Tiger, Asian Elephant, Gaur and Banteng in Vietnam, Lao, Cambodia and Yunnan Province (China), with recommendations for future conservation action*. Hanoi: WWF Indochina Programme.
- Specific information contained in the species accounts (Annexes 1-4) should be cited as "[Name] in Duckworth and Hedges (1998)".
- First edition: 1998
- Figures by: Tran Minh Hien, WWF Indochina Programme
- Cover design by: Bok Sakon, WWF Thailand Project Office
- Available from: WWF Indochina Programme
International PO Box 151
Hanoi
Vietnam
- Telephone: + 84 4 8220640
Fax: ++ 84 4 8220642

The findings, interpretations, conclusions and recommendations expressed in this document represent those of the compilers and do not imply the endorsement of WWF. The designation of geographical entities in this document, and the presentation of the material, do not imply the expression of any opinion on the part of WWF concerning the legal status of any country, territory, or area, or its authorities, or concerning the delimitation of its frontiers or boundaries.

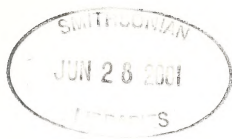
ISBN 2 - 88085 - 225 - 0

SCIENTIFIC PUBLISHING HOUSE

Publishing Licence No. : Đ/K KHXB 915-68 (7/10/1998).

Quantity : 1000 pcs, Size : (20.5 x 28) cm

Printed by Cartographic Publishing House, 10/1998.



CONTENTS

Acknowledgements	5
Non-standard abbreviations and conventions	
Abbreviations and acronyms	9
Conventions.....	10
EXECUTIVE SUMMARY OF FINDINGS AND RECOMMENDATIONS	
Summary of activity and main findings	13
Recommendations for addressing conservation needs of the focal species	17
PART 1: INTRODUCTION.....	25
1.1 Aims of report.....	27
PART 2: METHODS	
2.1 Sources of information.....	29
2.2 Extraction of information.....	30
2.3 Presentation of information.....	30
PART 3: RESULTS AND DISCUSSION	
3.1 The current status of the focal species in Indochina	33
3.1.1 The current status of Tiger in Indochina	33
3.1.2 The current status of Asian Elephant in Indochina.....	38
3.1.3 The current status of Gaur in Indochina	44
3.1.4 The current status of Banteng in Indochina.....	48
3.1.5 Notes on the status of Asian Tapir, Kouprey, Asian Buffalo and rhinoceroses in Indochina.....	52
3.1.6 Distribution of the focal species with respect to protected areas	54
3.1.7 Distribution of focal species with respect to Tiger Conservation Units.....	57
3.2 Limitations of the analysis	60
3.2.1 Uneven geographical coverage	60
3.2.2 Lack of specimens.....	60
3.2.3 Poor quality fieldwork	61
3.2.4 Interpretation of village information	61
3.2.5 Weak documentation of findings	64
3.2.6 Plagiarism of findings	67
3.2.7 Falsification of findings	67
3.2.8 Poor dissemination of information	68
3.2.9 Lack of information concerning protected areas and other localities.....	68
3.3 Threats to the species in Indochina	69
3.4 Current conservation initiatives for the species in Indochina	70
3.4.1 Information gathering	70

3.4.2	Putting the information to use.....	71
-------	-------------------------------------	----

PART 4: RECOMMENDATIONS FOR FUTURE SURVEY WORK

4.1	Sites and areas needing survey	73
4.1.1	Surveys centred upon Lao	74
4.1.2	Surveys centred upon Yunnan Province	75
4.1.3	Surveys centred upon Vietnam	75
4.1.4	Surveys centred upon Cambodia	76
4.2	Survey methodology and implementation.....	77
4.2.1	Identification of species and individuals from their signs	78
4.2.2	Presence-absence surveys.....	81
4.2.3	Indices of relative abundance and estimates of population density	81
4.2.4	Population estimation	85
4.2.5	Censuses.....	86
4.2.6	Population trend	87
4.3	Monitoring of areas	87
4.4	Presentation of survey and monitoring results	88
4.4.1	Accurate presentation of the survey locality	88
4.4.2	Dating of information	89
4.4.3	The value of photographs	89
4.4.4	The role of local language publications	90
4.5	Survey team composition	90
4.5.1	Surveyors	90
4.5.2	Local counterparts	91
4.5.3	Specific bodies in the region.....	91
4.6	Research into existing traditional beliefs	92
4.7	Incidental record gathering	93
4.8	Record keeping and information dissemination.....	94
4.9	Information from specimens.....	94
4.10	Research into ecology and population biology	95
4.11	Preparation of a survey techniques manual.....	95
4.12	Socio-economic survey needs.....	96

PART 5: RECOMMENDATIONS FOR PROTECTED AREAS

5.1	Protected area design.....	97
5.2	Habitat types within protected areas	97
5.3	Protected area size	98
5.4	Landscape-level area designation	99
5.4.1	Corridors	99
5.5	Appropriate boundary delineation of protected areas.....	102
5.5.1	Dangers of the use of natural features.....	102
5.5.2	Dangers of increased access	102
5.6	Access to protected areas.....	102
5.7	The importance of reserve buffer zones, logging concessions and other surrounding habitat	103

5.8	Trans-boundary linkage	104
5.9	Management of small populations	106
5.10	Protected area management policy	107
5.10.1	Integrated Conservation and Development Projects	107
5.10.2	The need for monitoring management progress	109
5.10.3	The need for inviolate cores zones	110
5.10.4	Combatting poaching	111
5.10.5	Possible partners in management	112
5.11	Need for strengthening region-wide protected area staff motivation and capability	112

PART 6: RECOMMENDATIONS FOR ADDRESSING POLICY ISSUES

6.1	Hunting	115
6.2	Maintenance of ungulate prey base for big cats	115
6.2.1	The critical role of the prey base	115
6.2.2	Firearm restriction	116
6.2.3	Trapping	116
6.2.4	Wildlife meat consumption	117
6.2.5	Concluding remarks	117
6.3	Resolution of human-wild animal conflict	118
6.3.1	Background	118
6.3.2	Scale of the problem	118
6.3.3	The need for set policy and rapid action	119
6.3.4	Issues specific to Tiger	120
6.3.5	Issues specific to Asian Elephant	120
6.3.6	Liaison with land-use projects	125
6.3.7	Individual problem animals	126
6.4	Major land-use projects	126
6.5	International trade	127
6.6	Captive breeding	131
6.7	Public awareness	132
6.8	Coordination of action	134
6.8.1	Formulation of national action plans	134
6.8.2	International co-operation	135
6.8.3	The need for long-term external funding	136
6.8.4	The role of international organisations	137

Afterword:	the role of the focal species in biodiversity conservation in Indochina	141
------------	--	-----

REFERENCES	143
------------------	-----

ANNEXES

Key to abbreviations in Annexes 1-4	163
---	-----

Annex 1: Tiger records from Indochina	
Vietnam	165
Lao	177
Cambodia	189
Yunnan Province	194
Annex 2: Asian Elephant records from Indochina	
Vietnam	197
Lao	209
Cambodia	223
Yunnan Province	228
Annex 3: Gaur records from Indochina	
Vietnam	231
Lao	241
Cambodia	253
Yunnan Province	257
Annex 4: Banteng records from Indochina	
Vietnam	259
Lao	264
Cambodia	273
Yunnan Province	277
Annex 5: Administrative province location of protected areas in Lao and Cambodia	
	279
Annex 6: Scientific names of mammal and bird species mentioned in the text	
	281

List of tables

Table 1: Sites in Indochina with recent confirmed records of the focal species	14
--	----

List of figures

Fig. 1: Recent information on the distribution of Tiger in (a) Indochina (b) Vietnam, Laos and Cambodia.	34
Fig. 2: Recent information on the distribution of Asian Elephant in (a) Indochina (b) Vietnam, Laos and Cambodia.	39
Fig. 3: Recent information on the distribution of Gaur in (a) Indochina (b) Vietnam, Laos and Cambodia.	45
Fig. 4: Recent information on the distribution of Banteng in (a) Indochina (b) Vietnam, Laos and Cambodia.	49

ACKNOWLEDGEMENTS

It would not have been possible for us to assemble this information without the help, usually freely given, of the many people below; we apologise in advance for any omissions.

Cambodia:

Chay Samith (Acting Director of Department of Nature Conservation and Protection, Ministry of the Environment); Sun Hean (Deputy Director, Wildlife Protection Office, Department of Forestry and Wildlife); Lic Vuthy and Men Soriyon (WPO); His Excellency Chhun Sareth (Under-Secretary of State, Ministry of Agriculture, Forestry and Fishery); Seng Teak, Lay Khim and Kensrey Rotha (MoE / WWF Phnom Penh); Worm Sorensen and Lincoln Young (European Commission Support Programme to the Environmental Sector in Cambodia); Paul Im (Environmental Technical Advisory Project, Ministry of the Environment / UNDP); Joe Fraley and Bob Maves (Joint Task Force-Full Accounting Program, Cambodia Detachment); Sim Paat (Head, Wildlife Protection Service, Battambang Provincial Forestry and Wildlife Office); Hunter Weiler (Kouprey Reconnaissance Project); David Ashwell; Frederic Goes; Andrew Maxwell; Colin Poole; Vicki Nelson; Thomas Kunneke.

Lao:

Chanthaviphone Inthavong, Venevongphet, Siwannavong Sawathvong, Boonhom Sounthala, Khamkhoun Khounboline, Sirivanh Khounthikoumane, Sounthaly Muontha and others (CPAWM); Stuart Chape (IUCN-Lao PDR office); Klaus Berkmüller (IUCN-Biodiversity Conservation Project); Joost Foppes and Rachel Dechaineux (IUCN-Non-Timber Forest Products Project); Bill Gadoury (Joint Task Force-Full Accounting Program, Lao PDR Detachment); Clive Marsh and Ramesh Boonratana a.k.a. Zimbo (Lao-Swedish Forestry Co-operation Programme); Jean-François Reumaux (Nam Kan NBCA); John Parr (Phou Khaokhoay NBCA); Jörgen Hesse, Dietmar Bräutigam and Chanthaphone Phon-Asa (Vientiane Forestry College / Lao-German Forestry Team); Bill Robichaud, Chanthavi Vongkhamheng, Pete Davidson, Troy Hansel, Mike Meredith, Ole-Gunnar Støen and Dave Showler (WCS Lao); Rob Tizard and Prithiviraj Fernando (WWF Lao); Rob Timmins; Tom Evans. Special thanks to the WCS Lao Program for allowing use of their office and facilities as a base during work in Vientiane, supplying field data *ad lib.*, providing numerous references and answering endless detailed questions.

China:

Wang Sung (Beijing Institute of Zoology, Academia Sinica); Guo Huijun (Chinese Academy of Sciences-Kunming Branch); Jiang Wang Gao (Department of Biology, Yunnan University); Wu Zhaolu (Institute of Ecology and Geobotany, Yunnan University); Wang Yingxiang and Wen Xianji (Kunming Institute of Zoology, Chinese Academy of Sciences); Zhu Xiang (National Wildlife Monitoring Center);

Wang Weimin, Su Jhieng Gue and River Chuan Liang (Wildlife Protection Office of Yunnan Forestry Bureau); Sun Changjin, Lü Zhi, Yu Changqing and Bill Bleisch (WWF China, Beijing). Special thanks to the Kunming Institute of Zoology for providing accommodation and arranging contacts.

Vietnam:

A special thanks is owed to Do Tuoc (Forest Inventory and Planning Institute) for taking time out of his own cramped survey schedule to guide us through the results of his years of fieldwork in Vietnam. Information and / or advice was also received from: Jonathan Eames, Le Trong Trai and Nguyen Cu (BirdLife International); Vo Quy, Truong Quang Hoc, Pham Binh Quyen and Vu Dieu Huong (Centre for Natural Resources and Environmental Studies, Hanoi); Pham Nhat (Department of Wildlife Management, Forestry College of Vietnam); Joe Walston and Mike Baltzer (Fauna & Flora International); Vu Van Dung and Nguyen Huy Thang (FIPI); Do Quang Tung and Pham Mong Giao (Forest Protection Department); Miles Kemplan (Frontier-Vietnam); Dang Gia Tung (Hanoi Zoological Gardens); Nguyen Xuan Dang, Trinh Viet Cuong, Pham Trong Anh and Dang Huy Huynh (Institute of Ecology and Biological Resources); Hans Friederich (IUCN-The World Conservation Union, Hanoi); Le Vu Khoi and Ha Dinh Duc (Vietnam National University); Tran Minh Hien, Hoang Van Thang, Tom Dillon, David Hulse, Jack Hurd, Nguyen Thi Dao, Eric Wikramanayake, James Compton and others (WWF Indochina Programme). Particular thanks are given to Tran Than Quang (WWF) for repeated assistance beyond the call of duty.

Outside Indochina:

R. Sukumar, Vivek Menon and Arun Venkataraman (Asian Elephant Conservation Centre); Sompoad Srikosamatara and Philip Round (Center for Conservation Biology, Mahidol University, Bangkok); S. C. Dey (Global Tiger Forum); Peter Jackson and Kristin Nowell (IUCN/SSC Cat Specialist Group); Alison Rosser (IUCN/SSC Wildlife Trade Programme); F. Bagley (US Fish and Wildlife Service); Alan Rabinowitz, Joshua Ginsberg, Cheryl Chetkiewicz and Ellen Bean (WCS); Ullas Karanth (WCS-India); Tony Lynam (WCS-Thailand); Rob Steinmetz, Robert Mather, Siripong Thonongto, Bok Sakon and U Tin Than (WWF Thailand); Elizabeth Kemf and Praven Bhalla (WWF International); Thomas Mathew (WWF-US); Sarah Christie (Zoological Society, London); Guy Anderson; Dan Duff; Arthur Ebreget; Frank Hawkins; John MacKinnon; Roger Safford; Gerry Schroering; Joe Tobias; James Wolstencroft; Anouchka Nettelbeck.

Report reviewers:

Many people took the time and concentration to comment constructively and in great detail on an earlier draft of the report. The challenges of resolving the problems facing the focal species meant that divergent opinions on the best actions were not infrequent. Thus, the final report cannot follow all the views expressed but all were taken into consideration. We are very grateful to Tom Dillon, Jonathan Eames, David Hulse, Chanthaviphone Inthavong, Peter Jackson, Ullas Karanth, Elizabeth Kemf,

Khamkhoun Khounbolin, Lic Vuthy, Tony Lynam, Clive Marsh, Vivek Menon, Chad Ovel, Pham Nhat, Colin Poole, Alan Rabinowitz, Bill Robichaud, Siwannavong Sawathvong, Rob Steinmetz, Ole-Gunnar Støen, Rob Timmins, Rob Tizard, Venevongphet, Arun Venkataraman and Joe Walston.

Bok Sakon designed the cover and generously permitted us to use it on this report.

The publication was produced with a grant from World Wildlife Fund in the United States, a member of the World Wide Fund for Nature International Network. Supplementary funding was provided by WWF Indochina Programme.

NON-STANDARD ABBREVIATIONS AND CONVENTIONS

Abbreviations and acronyms

AECC	Asian Elephant Conservation Centre, Bangalore, India
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CPAWM	Centre for Protected Area and Watershed Management of the Department of Forestry of the Ministry of Agriculture and Forestry, Vientiane (Lao)
DNCP	Department of Nature Conservation and Protection of MoE (Cambodia)
FFI	Fauna & Flora International
FIPI	Forest Inventory and Planning Institute of the Ministry of Agriculture and Rural Development, Hanoi (Vietnam)
GIS	Geographical Information System
ICDP	Integrated Conservation and Development Project
IEBR	Institute of Ecology and Biological Resources, Hanoi (Vietnam)
IUCN	The World Conservation Union
LSFCP	Lao-Swedish Forestry Cooperation Programme
NBCA	National Biodiversity Conservation Area (Lao)
NGO	Non-governmental Organisation
NNR	National Nature Reserve
NP	National Park
NR	Nature Reserve
PDR	Peoples' Democratic Republic
RAS	UNDP code for Asia Pacific Region
sect.	section (of this report)
SSC	Species Survival Commission of IUCN
TCU	Tiger Conservation Unit
UNDP	United Nations Development Programme
UNTAC	United Nations Transitional Authority in Cambodia
UTM	Universal Transverse Mercator
WCS	Wildlife Conservation Society
WS	Wildlife Sanctuary
WPO	Wildlife Protection Office of Department of Forestry and Wildlife, Ministry of Agriculture, Forestry and Fishery, Phnom Penh (Cambodia)
WWF	WorldWide Fund for Nature / World Wildlife Fund (North America only)

Conventions

Tiger, Asian Elephant, Gaur and Banteng are the "focal species" of very large mammal species; the "very" is necessary, as, since at least the publication of Dorst and Dandelot (1970), any mammal species identifiable in the field may be referred to as a "large" mammal.

Asian Elephants kept by people are referred to as 'tamed' (rather than various other possibilities such as 'domestic(ated)', 'tame', 'captive', 'working' etc.) following R. Sukumar (*in litt.* 1998). Lair (1997) chose 'domesticated' but was obviously less than happy with this; Asian Elephant is not a domestic species in the sense usually understood: an artificially selected gene-pool now separated from its wild ancestral stock.

Indochina in the biogeographical sense used in this report indicates Lao, Cambodia, Vietnam and Yunnan Province, China.

The Tay Nguyen Plateau is an administrative unit in Vietnam composed of Dak Lak, Gia Lai, Kon Tum, and, formerly, Lam Dong Provinces; although some times referred to in English as the 'central' or 'western highlands' this name is not used here as the parts of it important for large mammals comprise some of the most important remaining lowland habitats in Indochina.

Four different alphabets are widely used in the region. Lao, Khmer and Chinese names are each transcribed into Roman inconsistently, meaning that different Roman-alphabet spellings may indicate the same place. Even in Vietnam, which uses the Roman alphabet, alternative spellings were widespread: Yok Don National Park was also written as Jok Don, Jork Don, Yokdon, etc. Site spellings are largely taken from the source publication, although for each site it is intended that only one spelling has been used. Spellings of district and province names in Vietnam are taken from MPHVN (1997). Where possible, Lao names follow the gazetteer of historical and recent Lao survey localities in Thewlis *et al.* (*in press*).

Major geographical features crossing national boundaries are named internationally. The Mekong river is the Lancang Jiang in China, the Mae Nam Khong in Lao and the Mekong in Cambodia; the part within Vietnam is known locally as the Cuu Long. The Annamite mountain range is known as Sayphou Louang in Lao and as Truong Son in Vietnam. Other international features generally use the name in the country where the feature is most prominent, e.g. the Srepok river is called thus rather than the Dak Krong, as the upper reaches are called in Vietnam.

Records from adjacent to protected areas are often listed under the protected area, to give a clearer picture of the local situation. Administrative locations of protected areas for Lao and Cambodia are listed in Annex 5; those for Vietnam are given at each mention.

Co-ordinates are taken from Berkmüller *et al.* (1995a) for Lao National Biodiversity Conservation Areas and from source reports where presented. The Forest Protection Department of Vietnam provided co-ordinates for most protected area. Co-ordinates for others were taken by eye from maps and indicate the general location of the site. The information does not necessarily relate to these co-ordinates, nor are they confirmed as correct. This weakness was unavoidable given frequent poor presentation of locality information in source reports (sect. 3.2.5).

Adjectives describe the comparative health of a species's population in an Indochinese context. These were applied using area occupied, density of signs, local information on status, perceived threat levels and other indirect features. "Healthy" is generally used where it seems that *if protective measures are implemented immediately* the population may persist for at least a decade, in the absence of stochastic calamities. Such numbers (as few as 20) would not seem healthy in areas such as the Indian subcontinent or Java. The word "healthy" may suggest a misleadingly optimistic situation and outlook, but some division is needed to distinguish the regionally important numbers.

EXECUTIVE SUMMARY OF FINDINGS AND RECOMMENDATIONS

Summary of activity and main findings

1. All information traced pertinent to the status in Indochina (Lao, Vietnam, Cambodia and Yunnan Province) of **Tiger** *Panthera tigris*, **Asian Elephant** *Elephas maximus*, **Gaur** *Bos gaurus* and **Banteng** *B. javanicus* during the decade 1988-1997 is detailed by site. Information was taken from published papers, published and unpublished reports of wildlife surveys and other activities, supplemented by extensive discussion with people holding unpublished information.

2. **The species** were selected as they are globally under great threat, **require large areas** for viable populations, **have high international trade value** (thus are subject to specialist poaching and trading), **are sometimes in conflict with people** (they threaten human lives and / or livelihoods), **can survive in landscapes containing some areas of degraded habitats, need certain habitat features, and have a high public profile**. The main habitat problem facing all four is the shrinkage in wilderness area.

3. The information gathered is used together with review of existing work to formulate recommendations for future regional conservation of the species.

4. **Recent information is very scarce for Cambodia, scarce for Vietnam and Yunnan Province and patchy for Lao**; this hampers comparison across the region. Furthermore, **information in many source documents was not accurate**. Problems were identified with: **lack of confidence in identifications; poor quality fieldwork**, sometimes involving inappropriate personnel and methodologies; inappropriate interpretation by surveyors of **villagers' information; weak and imprecise documentation** of findings; and, in Vietnam, **plagiarism** and sometimes **falsification** of findings. There is also rather **poor dissemination** of information, and in Vietnam basic information traced concerning protected areas (names, locations, status) was contradictory.

5. All focal species were probably distributed throughout the area in historical times although Banteng may have been less widespread, as it seems not to inhabit extensive closed-canopy evergreen forest.

6. Table 1 summarises the current known distribution of the four species.

Status and conservation of very large mammals in Indochina

Table 1: sites confirmed to hold the focal species in Indochina

No.	Site name	Tiger	Elephant	Gaur	Banteng
VIETNAM					
7	Muong Nhe SNR	X	X		
11	Sop Cop NR		X		
15	Pu Luong prop. NR			X	
17	Pu Hoat prop. NR		X	X	
18	Pu (= Bu) Huong NR		X		
19	Ben En NP		X		
23	Pu Mat NR		X		
26	Vu Quang NR	X	X	X	
27	Ho Ke Go NR			X	
31	Phong Dien District, Thua Thien - Hue Province	X			
33	A Luoi / Nam Dong Districts, Thua Thien - Hue Province	X			
35	Que Son District, Quang Nam Province		X		
36	Hien / Giang / Phuoc Son Districts, Quang Nam Province		X		
38	Tra My District, Quang Nam Province		X		
41	Kon Ha Nung, An Khe District, Gia Lai Province *1	X			
42	Chu Mom Ray NR	X	X		
43	Song Ba / Song Kon rivers *2	X			
47	Ea Sup District, Dak Lak Province		X	X	X
48	Yok Don NP	X	X	X	X
51	Ea So prop. NR			X	X
53	Dak Mil / Cu Jut Districts, Dak Lak Province				X
54	Chu Yang Sin NR		X		
58	Bu Gia Map NR	X			
61	Ninh Son District, Ninh Thuan Province			X	X
65	Cat Tien NP		X		X
70	Tan Phu Forest Enterprise		X		
71	Bien Lac - Nui Ong NR		X	X	
LAO					
80	Phou Dendin NBCA		X		
82	Boun Nua District, Phongsali Province		X		
83	18 km SE of Muong Yo, Phongsali Province		X		
85	Nam Kong Prov. PA		X		
88	Phou Dongwin			X	
89	Nam Ha (East and West) NBCA	X		X	
90	Nam Kan prop. NBCA	X	X		
92	Nam Et NBCA	X	X	X	
93	Phou Loeuy NBCA	X		X	
94	Nam Xam NBCA		X	X	
106	Nam Phoun (= Pou) NBCA	X	X	X	
109	Phou Khaokhouy NBCA		X		
110	Sangthong District, Vientiane Municipality		X		
112	Nam Kading NBCA		X	X	
114	Nam Theun Extension prop. NBCA	X			
113	Nam Hinboun plain		X		
115	Nakai-Nam Theun NBCA	X	X	X	

116	Nakai Plateau	X	X	X	X
117	Nam Theun Corridor prop. NBCA		X		
118	Khammouan Limestone NBCA		X		
119	Hin Namno NBCA	X	X	X	
120	Xe Bang Fai former prop. PA	X			
121	Phou Xang He NBCA	X	X	X	
122	Dong Phou Vieng NBCA		X	X	
123	Xe Sap NBCA		X		
126	Xe Bang-Nouan NBCA	X	X		
127	Phou Xiang Thong NBCA	X	X		X
128	Ban Phonthan, Saravan Province	X			
132	Dakchung Plateau	X	X		
133	Phou Ilang former prop. NBCA				X
134	Bolaven Northeast (= Phou Kateup) prop. NBCA		X		
135	Bolaven Southwest (= Phou Luang) prop. NBCA		X		
136	Xe Khampho prop. NBCA			X	X
137	Phou Kathong prop. NBCA		X		
138	Dong Ampham NBCA	X	X	X	
140	Dong Hua Sao NBCA	X		X	
139	Nam Ghong Prov. PA	X	X	X	
141	Xe Pian NBCA	X	X	X	X
142	Dong Khanhthung prop. NBCA	X	X	X	X

CAMBODIA

150	Virachey NP	X	X	X	
152	Phnom Voene, Ratanakiri Province				X
155	O'Ta Pok, Ratanakiri Province		X		
156	North and west of Ban Lung, Ratanakiri Province		X	X	X
161	Lomphat WS				X
163	Bouvel District, northwest Battambang Province		X		
164	Northeast Mondulakiri Province	X	X	X	X
165	East Mondulakiri Province	X	X	X	X
166	Phnom Prich WS				X
167	Phnom Koe, Pursat Province	X	X		
168	Phnom Nam Lyr WS				X
173	Phnom Bokor NP		X		
174	Ream (Preah Sihanouk) NP		X		

YUNNAN

186	Nanguanhe NR	X	X	X	
189	Zulin, Simao Country, Prov. NR			X	
192	Jiangchung County		X		
193	Xishuangbanna NR	X	X	X	

*1: Kon Ha Nung area incorporates Buon Luoi, Kon Cha Rang NR and Kon Ka Kinh NR.

*2: Song Ba / Song Kon (=Dak Kron Bung) lie in K'Bang District, Gia Lai Province, Kon Plong District, Kontum Province and adjacent parts of Binh Dinh Provinces.

Only sites where at least one of the focal species had been confirmed to occur during 1988-1998 are listed. Some sites of undoubted exceptional importance to very large mammals are not listed (e.g. Cat Loc Nature Reserve, Vietnam) as no report has been traced. Their distribution as given in the table is

therefore a minimum.

Sites vary widely in size; no standardisation of area covered by a site was possible as they were based on survey / reporting units.

7. In the last 30 years **Tiger** numbers have probably plummeted in **Vietnam**. There is little evidence for viable numbers away from the western border of the country. Even here animals are scattered and numbers are probably low. Chu Mom Ray Nature Reserve (Kon Tum Province) may be the most important area. In **Lao** Tigers still inhabit most remaining forest blocks, but densities are very low. Several regions are important, most of which are in protected areas. In **Cambodia** reports suggest that Tigers are still widespread but densities are probably low. The limited law enforcement in Cambodia may mean that numbers are dropping faster in there than elsewhere. Tigers seem very scarce in **Yunnan Province**, perhaps being reduced to isolated individuals, with most in Xishuangbanna National Nature Reserve.

8. **Asian Elephants** remain in only scattered disrupted herds in **Vietnam**, with possibly a few dozen in a few areas. Most are along the Annamites, with outliers to the south. Many are outside protected areas. **Elephant populations remain healthy in Lao** and potentially viable numbers live in many National Biodiversity Conservation Areas across the country. Good numbers also occur outside the protected area system. Several areas are of outstanding importance. In **Cambodia** reports suggest that the Kravanh mountains support very large numbers, but investigations of other areas previously believed to be important have found few. The Xishuangbanna National Nature Reserve of **Yunnan Province** retains several herds of Asian Elephants and numbers have reportedly not declined in the last 20 years. A few animals occur outside this area.

9. **Gaur** persist across the remaining forests of **Vietnam** but are so sparse that local extinction across many sites could occur quickly. In **Lao**, they have a patchy distribution but several NBCAs still hold important numbers. Most NBCAs with closed canopy forest on hilly terrain support at least a few animals; populations in more accessible terrains have declined more markedly through hunting. Substantial numbers probably remain in **Cambodia** and in **Yunnan Province**. Protected areas cater well for the species.

10. **Banteng** occurs mainly in open deciduous forest where hunting is easy. **Cambodia is likely to support the bulk of the region's population but 1998 information from a limited area indicates massive recent declines.** In **Lao** and **Vietnam** a few small herds are known in the south. The species may occur at one site in **Yunnan Province**. Important sites remain under-protected in all countries. **Without rapid action the species will soon become effectively extinct in Indochina.**

11. **Javan Rhinoceros** *Rhinoceros sondaicus* persists at Cat Loc Nature Reserve

(Vietnam). No other sites were found where it, or **Sumatran Rhinoceros** *Dicerorhinus sumatrensis*, **Kouprey** *Bos sauveli*, **Asian Buffalo** *Bubalis arnee* or **Asian Tapir** *Tapirus indicus* were confirmed to persist. **If these species still occur they are close to regional extinction**, and need specific action.

12. The **Tiger Conservation Unit (TCU)** prioritisation of areas was largely supported, but does not reflect well the situation in northern Lao where some extensive areas of degraded habitat remote from human settlement support Gaur, Tiger and Asian Elephant. The more important of these are already declared as National Biodiversity Conservation Areas or have been formally proposed as such. In the south of the region, some of the open habitats supporting high Banteng numbers were also classified as degraded and so were overlooked. **Greater concentration on remoteness of area and difficulty of access to hunters, rather than habitat structural condition, might allow a better predictive analysis** of where important, conservable, populations of Tigers and other large mammals remain.

13. **Areas important for one focal species tend to support others**; existing declared or formally proposed national-level protected areas cater well for these assemblages. In all countries **a few important sites have not been declared as protected areas**.

14. **The very high trade value of all the focal species in Indochina coupled with absence of effective anti-poaching and trade control measures is probably the most important short-term determinant of decline**. Low prey densities may be an equal problem for Tigers. Recovery of Tiger populations without addressing both these threats is impossible.

Recommendations for addressing conservation needs of the focal species

National action plans for the conservation of very large mammals should be drafted by the governments of the four countries with specialist assistance from the international conservation community. The plans should be endorsed as formal government policy. Stimulating the formulation of these is the highest priority for the international conservation community. Action plans should consider the points detailed below:

Surveys

1. **Basic distributional surveys are still needed across the region for all the species, especially Tiger and Banteng**. Further Asian Elephant surveys in Lao are important as the country contains the population with the best chance of long-term survival. Surveys in Cambodia for all species are of a lower priority as the uncertain security situation limits the ability to implement conservation recommendations from surveys.

2. A list of recommended survey areas is presented, prioritised within each country.

3. **'Rapid assessments'** have suffered from inappropriate personnel and insufficient focus of activities; most importantly, the failure to recognise that they do not substitute for surveys means that too much is trying to be taken from the results. They **are prioritisation exercises, not bases for shaping conservation policies and management plans.**

4. **Presence-absence surveys are the major research need and should be based around signs searches** using a rough measure of effort to give a broad idea of the species's local status. All surveys should tackle all four species.

5. Clearer appreciation of the **identification problems of focal species signs** is needed. Great caution is needed in telling Leopard and Tiger signs apart, and in distinguishing the various wild cattle from each other and from domestic bovines; local husbandry practices vary greatly in the region and should be understood prior to survey. Knowledge of the local status of tamed elephants is necessary to identify signs as being from wild animals.

6. **For big cats and cattle, collection of measurements of footprints of individuals where the species is known (e.g. by camera trapping) is a priority to allow refinement of identification characters.**

7. All **sign-based surveys should be treated as training exercises** to build local capacity. Surveys should be **preceded by intensive training** on the techniques to be used, outside the region, where animal numbers are higher. **External technical assistance should continue on all surveys through report production** as in all countries data analysis and report writing lag considerably behind field skills. Long-term one-to-one association of senior scientific staff with experienced surveyors will allow the firmest growth in national capacity. **Surveys should** be designed to act as a base-line for monitoring, i.e. they **should be repeatable.**

8. More careful selection of external technical assistance is needed than has been the case on some recent surveys. Local participants should include those able to absorb skills and those involved in managing the area.

9. Populations cannot be estimated for these species on distribution surveys. Prolonged study at individual sites would be needed, but currently **it is more important to measure population density gradients (in time and space) than population size itself.**

10. If very large mammal surveys take place **during an inter-disciplinary project, a full-time sign-surveyor should be included in the team** and be given free reign to work at his / her own pace. Expecting generalists to record signs 'on the side' severely compromises the interpretation of the findings, while expecting sign-surveyors to work across areas at a team pace usually constrains efficiency seriously.

11. **Photographs should be taken wherever possible of remains** (in the field and in local possession), **signs and where possible live animals**. All photos should be curated as carefully as biological specimens. A sheet of paper giving date, locality and photographer should be included in the exposure along with an object for scale; photographs of living animals should use the automatic dating device if present in the camera.

12. Survey reports should be written more clearly than many currently are, presenting concisely all information on the focal species with all evidence given precise sites and dates. **Information taken from local people should include date of both report and last sighting**. Maps should be clear and accompanied by a scale bar and appropriately-spaced co-ordinate grid. **A gazetteer of vital statistics for all localities reported upon is of inestimable value** to future users of the report, including those who wish to enter the data into GIS programs.

13. Adequate budgeting (of time and finance) is necessary for **all reports to be translated fully into the local language**. Producing them only in English stifles local writing capacity and restricts access to the information.

14. Research into the type and level of protection afforded to the focal species by traditional beliefs in the region should be conducted; existing beliefs may facilitate future conservation endeavours.

15. Contact should be made with people going into remote areas for other reasons with a request that they provide information on the focal species and area.

16. **More comprehensive distribution of reports and better library facilities are needed in all countries**. All reports should be held by all the relevant government bodies and one or more international organisations active in wildlife conservation in the country, and in recognised institutions internationally.

17. **Research into ecology and population biology** of the focal species is most beneficial for their conservation if it is conducted by local biologists with adequate external supervision. Academically credible investigation of suggested survey methodologies is also important.

18. A **survey techniques manual** to set standards, and standardise, basic work should be prepared in all local languages and in English.

Protected areas

19. **The general protected areas system cannot meet the full needs of these species** as such large areas are needed for viable numbers. Instead, landscape-level tracts are needed with **totally protected core zones in key parts** of them. Land use in the rest of the area should be compatible with maintenance of very large mammal populations. **Habitat corridors are likely to be important** components of managed

landscapes. Reserve **buffer zones, logging concessions and other degraded areas can provide highly productive habitat for the focal species if hunting and encroachment are addressed.**

20. Lao and Cambodia already have designated a system of landscape-level areas. **Core zones remain to be defined in most.** Acceleration of this process is needed so that on-ground management can begin in earnest.

21. **The main need of core zones for the focal species is to provide areas with no / low human influence.** Human presence affects the focal species far more than does habitat condition or type.

22. **Intervention techniques** for the management of small populations (e.g. translocation and captive breeding for release) **are experimental, costly** and deflect attention from more fundamental issues. Every effort should be made to protect wilderness areas sufficiently large that these techniques will not be needed.

23. **Boundaries of protected areas should not where possible follow water-courses,** which are vulnerable habitat features important for the focal species, **nor should boundaries be constructed in a way to facilitate access** to the area (e.g. as cleared rides through forest).

24. **Every effort should be made to prevent the opening up of remote areas, including protected areas.** Roads facilitate access to poachers and other illegitimate users; the evolving protected area management systems and personnel in the region are not yet in a position to tackle this extra burden. The areas with the healthiest remaining numbers of focal species are primarily remote areas of rugged terrain. **Inaccessibility will continue to be the best protection for wildlife and habitat for several more years.**

25. **Having protected areas abut each other across borders is of particular value to very large mammals,** both across provinces and across countries. Priority sites are listed based upon their mammal populations and potential for parallel management to give large effective areas.

26. Protected areas with numerically important populations of the focal species should be priority areas for innovative management intervention.

27. The limited evidence gathered to date concerning **ICDPs** (Integrated Conservation and Development Projects) suggests that they **are likely to fail the focal species unless all stakeholders grasp that large inviolate core zones are integral to biodiversity conservation of the area, and unless external funding is long term.**

28. **Management progress** in protected areas **should be assessed with site-specific**

biological monitoring programmes. The focal species are among the most demanding management challenges and monitoring their status is an important component in such programmes.

29. Evidence from outside the region suggests that frequent active patrolling in remote parts of protected areas reduces poaching. Core zone management should include **energetic proactive armed anti-poaching patrols with clear plans based on local intelligence networks.**

30. Collaboration in wildlife management with other patrolling disciplinary bodies, such as border police, should be explored.

31. **Protected area staff across the region are engaged in a relatively new job.** Considerable support in various forms is necessary for them to attain the aptitude and motivation of their peers in countries with long-established protected area systems. Park staff from Indochina should be taken to successful parks in India and Nepal, for example, to study active protection methods.

32. Success in protected area management is a key issue in the fate of the focal species. **Long-term one-to-one association of promising reserve managers of important areas with externally funded protected area advisors is having promising results** and should be more widely spread.

33. **Social standing of protected area staff should be improved.** Research is needed into how this can best be achieved.

Policy issues

34. **Hunting is problematic not only in cases of direct poaching of the focal species; it is also depleting the prey base for Tigers.** Support should be given to ongoing initiatives in the region to reduce gun use by civilians, moderate sale of wildlife meat, and to work with local communities to implement self-set regulation of quarry species harvesting. The widespread use of snares and other non-selective traps is a major issue. Their use should be ceased as soon as possible in all protected areas and phased out elsewhere.

35. **Human-Tiger / Asian Elephant conflict is locally a major impediment** to promotion of large mammal conservation among communities, and nationally it is a serious drain on the conservation purse, at least in Yunnan Province, through compensation payments. Regional and national authorities should develop standardised response procedures to deal with incidents to avoid local people taking unilateral decisions to resolve problem situations. A comprehensive policy is needed in each country; this may best be formulated by adapting measures from other countries to fit the local situation.

36. **Long-term resolution of Tiger conflict is best addressed by re-establishing**

natural ungulate numbers across large core zones accompanied by appropriate stock husbandry practices in problem areas. In the short-term, some form of compensation scheme may need to be introduced.

37. **Asian Elephant conflict is more complex in origin.** Resolution will need not only the management of extensive areas to provide sufficient suitable natural food but also careful siting of vulnerable crops (bounded by unpalatable crops) in problem areas accompanied by experimentation with trenching, electric fencing, sacrificial planting and aversion therapy. Of these techniques, **trials to assess the value of trenching, sacrificial planting and aversion therapy are a high priority.**

38. Translocation of focal species in Indochina is unlikely to be appropriate in the foreseeable future, either as a population management method or as a solution to conflict. **Lethal control of individual problem animals may be the only solution in some cases.**

39. **Captive breeding currently has no clear role in the long term conservation of the focal species in Indochina** and should not drain resources from ecosystem conservation.

40. **Major land use projects** in areas important for the focal species should be **preceded by careful environmental impact assessment.** This is particularly important for hydropower and re-settlement projects.

41. **International trade is a major threat to the focal species.** It is present because there is a high demand. The trade is run by professionals; local people who collect the animals are merely taking advantage of an existing opportunity, and are therefore not the main impetus behind the trade. **Anti-trade measures should continue to tackle, through education and public awareness, the market.** Punitive measures should concentrate on punishing key figures who orchestrate the trade (not local hunters) with penalties as severe as any available for use in the country. Cross-border initiatives are critical for Indochina where animals may be killed in one country, transported through another and sold in a third.

42. Lao should be encouraged to become a party to the **Convention in International Trade in Endangered Species (CITES)** (Vietnam, China and Cambodia already have joined) and all countries should be given assistance to develop enabling legislation for international and domestic trade. Active enforcement of these laws should be encouraged. This requires major training and awareness initiatives in all countries.

43. **Banteng should be added to CITES Appendix I** (no commercial trade) at the next opportunity.

44. **Existing public awareness campaigns** should be promoted to conserve the focal

species in the region, with further ones designed and implemented, **addressing trade** (as driven by **medicinal use** and **trophy collecting**), **agriculture** (especially including **livestock husbandry** techniques) to reduce conflict with large mammals, the need for protection of **large remote wilderness areas** of limited accessibility, **relevant laws**, and others.

International co-operation

45. **International action is needed in two main fields:** collaboration between the four countries in policy development and implementation, including declaration of protected areas abutting each other across borders; and provision of international resources (financial and technical).

46. IUCN/SSC (Species Survival Commission) specialist groups exist for all the focal species. Their expertise should be drawn upon at all stages of all initiatives.

47. **Conservation of the focal species in the region entails opportunity costs.** The countries themselves are unlikely to be able to meet these. If the international community wishes to preserve these species, it must pay for the privilege by funding management of high priority areas into the foreseeable future.

48. **International organisations have a responsibility to their funders to use resources for projects of the highest global benefit** (within the organisation's remit), and should be transparently accountable for their actions. This prioritisation will necessitate some difficult decisions.

49. **Local capacity-building should be a primary aim of international organisations.** More care is needed with the selection of technical assistants for this process. Their roles need to be more clearly defined to ensure that benefit to local participants is maximised.

50. Encouraging local scientists to become more involved with the IUCN Species Survival Commission through its specialist groups is likely to consolidate professional growth for them.

PART 1: INTRODUCTION

The ongoing Action Plan series published by the Species Survival Commission of IUCN-The World Conservation Union (IUCN/SSC) since the early 1980s has treated both single species (e.g. Kouprey *Bos sauveli*, MacKinnon and Stuart 1988, and Asian Elephant *Elephas maximus* Santiapillai and Jackson 1990) and larger groups (e.g. wild cats, Felidae; Nowell and Jackson 1996). As the series has developed, the status information included has tended to expand and many are now called "status surveys and action plans". Even so, their purpose is not to serve as detailed status reviews for every country within the range of every species covered.

However, an effective conservation strategy necessitates understanding the status of the species (e.g. Margules 1989); specifically, "knowledge of individual localities from which a species has been recorded through time is required for the objective determination of priorities centred on both species and areas" (McGowan and Gillman 1997). This document, therefore, gives current status assessment of four species (henceforward, focal species) of very large mammal in Lao, Cambodia, Vietnam and Yunnan Province (henceforward, Indochina). These are not 'focal' species *sensu* Lambeck (1997), but merely the species upon which the report focuses. Global action plans treat two: Asian Elephant (Santiapillai and Jackson 1990) and Tiger *Panthera tigris* (Nowell and Jackson 1996), while a global plan shortly to be published will cover the other two, Gaur *Bos gaurus* and Banteng *B. javanicus* (Hedges in prep.). The Asian Elephant global action plan, compiled from data now over a decade old, is currently under revision.

Collating all extant information on the recent wild status of Tiger and Asian Elephant in Indochina will facilitate regional action planning. Early in the process of collating information, it became clear that the other two very large mammals with a relatively wide distribution in the region, Gaur and Banteng should also be covered: wild cattle share with Tiger and Asian Elephant many features including conservation needs. Little modification of field management and policy planning aimed at Tigers or Asian Elephants is needed to allow benefits for the others. The shared features are:

- All need large areas to support viable populations and are thus important considerations in promoting and positioning proposed and existing reserves and the corridors between them.
- All threaten human lives and / or livelihoods, increasingly as their habitats fragment, while simultaneously human populations rise.
- Their high financial value in illegal international trade subjects all to heavy poaching.
- All can survive some human modification of habitat: associated human persecution is more damaging than is habitat destruction *per se*.
- All occurred region-wide in suitable habitat but numbers are now a fraction of

those formerly.

- All need certain critical resources, particularly surface water and mineral licks (for Tiger the latter need arises through the needs of prey).
- Their high public profile means that substantial information exists about them.
- Some Yunnanese, Lao and ethnic Lao in Cambodia have taboos against harming these species.
- Tiger and Asian Elephant are favoured flagship species; combination allows a dual and thus a strengthened function in this respect.

Most other very large mammal species in Indochina sharing these features are reduced to such tiny numbers, or are even perhaps extinct, that meaningful region-wide planning is difficult (Asian Tapir *Tapirus indicus*, Kouprey *Bos sauveli*, rhinoceroses *Rhinoceros sondaicus* and *Dicerorhinus sumatrensis*, Asian Buffalo *Bubalis arnee* and Khting Vor *Pseudonovibos spiralis*) or their global priority is much lower (Leopard *Panthera pardus*). Three other species might usefully have been included in the exercise: Dhole *Cuon alpinus*, Asian Black Bear *Ursus thibetanus* and Sun Bear *U. malayanus*, but a time balance needed to be struck between expanding the project to cover extra species, and retaining sufficient time for the two species originally selected.

Lao, Vietnam and Cambodia have often formed one unit for biological recording purposes (e.g. Delacour and Jabouille 1940, Delacour 1940, Mlikovsky and Inskipp in prep.). Partly this reflects administrative history, but today they can still usefully be linked for several reasons aside from biogeography:

- All were closed to international scientists for several decades and there is a dearth of information concerning them. The common problems of information paucity and exchange are best solved by a regional approach.
- All are changing to more open, growth-centred economies. Rapid economic and social changes present challenges for conservation. Actions for each individual country will have generic applicability, at least partially.
- Trans-boundary reserves offer the best possibilities to protect the very large areas needed by viable numbers of the focal species.

Omission of parts of China, which shares the above features, from Indochinese compilations and projects is not justified. Over 60 years ago Osgood (1932) stated that "western China ... has a mammalian fauna many elements of which extend into French Indochina" and since then biogeographical similarities of Yunnan Province with Indochina have been reaffirmed. The omission of Yunnan Province from regional undertakings for Asian Elephant conservation, e.g. Lair (1997) and a project proposal of the Food and Agriculture Organisation of the United Nations (FAO), need particularly to be redressed as the population is numerically important and potentially conservable. China has also been left out by Tiger-focused undertakings (e.g. Dinerstein *et al.* 1997, Rabinowitz in press).

Conservation status of the focal species can change quickly, so this report focuses on the last ten years, i.e. 1988-1997. Earlier records are incorporated if they help

understand today's status and distribution. Information from 1998 has been incorporated as available.

1.1 Aims of report

This report is not a regional action plan. Many such plans "end up unattended just gathering dust on bookshelves. They remain unfunded because they are over-budgeted and / or are too ambitious to implement, or due to poor coordination between national implementing agencies and sponsors, or due to the lack of political will and motivation" (Dawson 1996). Additionally, many action plans (and indeed protected area management plans) achieve so little because they are rarely formulated by those with the final responsibility to decide what action is carried out where: national government. Design of national action plans should not be led by an international NGO; rather, the NGO should provide guidance and international perspective to the sovereign governments about what the action priorities are and how action might be achieved (see sect. 6.8.1).

Local action plans thus differ from global ones (such as the IUCN/SSC series), which are priority-setting exercises, drafted, for balanced presentation, by international expert(s) with substantial input from local representatives. National plans should be detailed, realistic, prescriptions for action on the ground, built around the internationally established priorities.

Thus, this present document does not set out specific projects with precise budgets for an anticipated time period. Instead, it presents the information upon which sound plans, developed by the countries themselves, can direct future action most appropriately. It is a synthesis of existing information which:

- gives a comprehensive current overview of the wild status of Tiger, Asian Elephant, Gaur and Banteng in Indochina;
- uses this to recommend future survey and management needs; and
- provides background discussion on issues to be addressed by national action plans.

The discussion on issues to be addressed aims neither to repeat nor paraphrase the extensive text of the IUCN/SSC action plans (Santiapillai and Jackson 1990, Nowell and Jackson 1996, Hedges in prep.). Issues are discussed here only where additional information / insight is available from within, or is needed for understanding the situation in, Indochina. **Understanding the complexities of issues concerning the conservation of these species will necessitate reference to the global action plans.**

The annexes to the document will be updated at regular intervals by the Conservation Science Unit of the WWF Indochina Programme and are available on disc. To allow comprehensive updating, it would be appreciated if copies of reports containing information (both those overlooked here, and those published in future) about the focal species could be forwarded to the office.

PART 2: METHODS

2.1 Sources of information

The status of the four species in Indochina was assessed from five sources:

- Published papers. Few international journal papers consider the fauna of the region, particularly over the last 30 years. Several journals in Vietnam contain relevant papers, notably *Tap Chi Sinh Hoc* (Journal of Biology). No national journals cater for Lao or Cambodia. Several Chinese journals cover Yunnan Province.
- Wildlife survey reports. Numerous organisations have conducted survey programmes or occasional surveys in the region. Notable is the WCS Lao Program, which is nearing the close of a set of base-line surveys of existing and proposed national protected areas. Very few protected areas in Cambodia have been surveyed. Surveys have apparently been mounted in many of the 80 or so Vietnamese national parks and nature reserves, but few reports were traced. Most were reconnaissances giving recommendations for management planning and future surveys.
- Reports of other surveys. The focal species have a high profile, so researchers in other disciplines often receive information. In particular, socio-economic reports often present data. Few such reports were covered as many of their identifications to species were questionable.
- Media articles. Local newspapers often include the species (conflicts with people, sightings in unusual areas, etc.), particularly in Vietnam. Most such reports seem reliable (Ha Dinh Duc verbally 1997). International media, being unlikely to carry primary information, were not searched.
- Personal communication. Appeals were made to numerous people for unpublished information, including:
 - a) active surveyors;
 - b) relevant central government offices;
 - c) people in remote areas for reasons other than wildlife survey.

Because of time limitations, information from Thailand was not reviewed, although for areas along the Lao and Cambodia borders, this could give valuable predictive information about where focal species survive. Hedges (in prep.) is using this approach.

2.2 Extraction of information

- From reports. Reports were skim-read to locate status information about the focal species and / or their management needs. Skimming was less thorough for material written in Vietnamese. Selected sections of these were translated face-to-face with a Vietnamese speaker with understanding of biological terms. Superfluous sections were discarded and uncertainties were clarified at the time. A few Chinese and Cambodian sources were treated in a similar way.
- From people. Directed questions covered several areas: what information was available?; what measures, including specific surveys, would they like to see undertaken?; could they draw attention to useful written sources or people?

Not all data were reliable (sects 3.2.2-3.2.7). Where data concerning focal species were brief, the general reliability of other information presented was taken into consideration.

2.3 Presentation of Information

Status information is given by site for each focal species (Annexes 1-4), in a roughly north-to-south order for each country. Sources precisely duplicating another are generally not cited. Sites were characterised by location (co-ordinates and Tiger Conservation Unit number, if any), protection status, confidence level and type of evidence of the species, and year of last positive information. Other information is presented under "notes". A database was not used as the patchiness of information meant that many cells would have remained blank. Most status information in the original source is given here, including precise site names; local 1:50,000 or 1:100,000 scale maps will be needed to interpret this information. Such detail is repeated because many original records are in documents of limited availability.

Records are listed under protected areas (when from within or adjacent to them) as the latter are units of survey and management. Because protected area size differs between countries, the number of occupied sites cannot be compared between them, and care is needed in interpreting the maps (specifically: density of symbols does not indicate density of population). Had the data been amenable, presentation of information by quarter-degree square would be better.

Differing levels of survey also hamper comparison between countries (sect. 3.2.1).

Population estimates are of limited value unless their derivation is explicit (sect. 4.2.4). Nonetheless, despite the urging of Karanth (1993) not to legitimise them through repetition, they are presented as so little information is available from many sites.

A species report is listed as confirmed, provisional, or extinct?. A multi-point scale (see sect 3.2.2) was not used as few records had sufficient detail to be assessed so precisely.

For **confirmed** records there is no reasonable doubt that the information does indeed refer to the species:

- direct field sightings;
- remains with local people where origin (site and rough date of capture) is established;
- signs where separation from confusion species (or, for Asian Elephants, the presence of tamed animals) had clearly been considered carefully; greater credibility was attached to people with substantial regional experience and whose reports recognised that many signs were not identifiable with certainty, than to those where substantial previous regional experience was not obvious and those who customarily claimed to identify difficult taxa with certainty. No minimum size cut off for Tiger prints (to rule out Leopard) could be set, because few sources gave measurements. Surveyors for WCS in Lao in 1994-1996 used 100 mm total length for a big cat print to be considered a Tiger. The ongoing lack of known measurements from wild big cats in Indochina hampers species identification of signs (sect. 4.2.1); and
- Detailed local information about Asian Elephants.

Information considered **provisional** included:

- that presented as such by the original source;
- reports from local people (except for elephants as above);
- signs, where identification seemed cavalier;
- specimens lacking locality data, even if identification was clear;
- claims where the type of evidence was not specified;
- specimens of Kouprey and "wild" Asian Buffalo, given some extreme cases of confusion over the former (see Hoffman 1986, Dioli 1995) and continuing uncertainty over the identification of buffaloes as wild, feral or hybrid (Hedges in press);
- sites with confirmed evidence only before 1988.

The category **Extinct?** was only used where there is evidence of past occurrence but extensive recent work has failed to find the species, or the site is now so unsuitable that continued regular occurrence seemed impossible.

Many provisional records probably do refer to the species claimed. Even obviously erroneous reports are included here to indicate that they were not overlooked. Questionable information was never listed as confirmed, although caution expressed over a provisional record was sometimes toned down for diplomacy's sake.

This data classification system was not used for Yunnan Province because field surveys are mostly detailed in Chinese which the present writers cannot read.

Trade information is incorporated only where it aids understanding of the wild status of the species.

PART 3: RESULTS AND DISCUSSION

3.1 The current status of the focal species in Indochina

Three of the four focal species occurred almost throughout the region within historical times. Gaur, Asian Elephant and Tiger probably inhabited naturally every province in Lao, Vietnam and Cambodia, and most of Yunnan Province (China). Banteng may have occurred more extensively than is currently confirmed. All have shown a marked contraction. All recent information traced for the four species is presented by site in Annexes 1-4. Sects. 3.1.1-3.1.4 summarise current distribution and population trends; Table 1 lists known sites for each species. Importance of sites is assessed using the area over which signs were found, or which is potentially inhabited.

3.1.1 *The current status of Tiger in Indochina (Fig. 1)*

Vietnam

Nguyen Xuan Dang and Pham Trong Anh (1991) suggested that prior to the 1970s Tigers lived in Vietnam from just north of Ho Chi Minh City to the Yunnan border, excepting a large area around Hanoi and a smaller one around Da Nang; a sharp decline over 20 years restricted them to isolated sites, mostly along the western border. As late as 1984 Tigers could be hunted freely, although in some areas the government tried to limit the kill to four per year (Pfeiffer 1984).

Do Tuoc *et al.* (1994) used information from over 2500 hunters and from mammal survey results from the former Ministry of Forestry (themselves largely based on interviews) to suggest that 150-250 Tigers were distributed over 17 provinces. Five regions held over 50 individuals each, but elsewhere numbers were thought to be small and nearing extinction. The incompleteness and low reliability of the data were stressed; Do Tuoc (verbally 1998) now feels that these numbers were too high. The higher estimate of Pham Trong Anh and Nguyen Xuan Dang (n/d) of 200-300 animals, repeated in Jackson (1997), also seems unrealistically high. Not surprisingly, Johnsingh and Nguyen Huu Dung (1995) concluded that available information on Tigers in Vietnam seemed "out of date and misleading".

Do Tuoc and Le Trong Trai (in prep.) synthesised information from provincial sources to suggest that by 1997 only 100 Tigers remained, with a dangerously dispersed distribution; Tigers were considered still to occur in 18 reserves in 17 provinces. Status seemed worst (approaching or already locally extinct) in the northeast of the country and in Cochinchina.

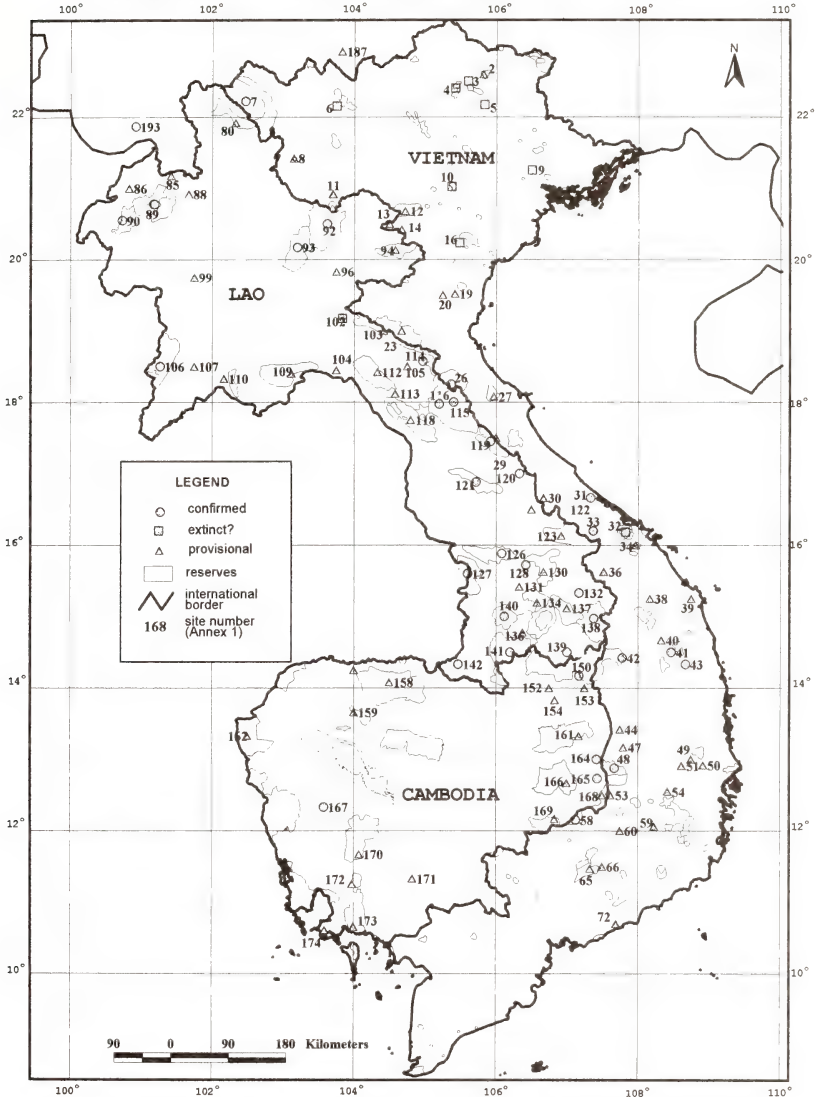
Five main areas are repeatedly said to be of prime importance:

- Sa Thay District, Kon Tum Province (centred on Chu Mom Ray Nature Reserve);

DISTRIBUTION OF TIGER IN INDOCHINA



DISTRIBUTION OF TIGER IN CAMBODIA, LAO AND VIETNAM



- Muong Nhe Nature Reserve (Lia Chau Province);
- western Dak Lak-southwestern Gia Lai Province;
- western Quang Nam Province; and
- western Quang Binh Province (including Phong Nha-Ke Bang Nature Reserve).

Tigers were recently confirmed in the first two, but evidence for continuing occurrence, let alone important numbers, in the others remains anecdotal. Indeed, these areas may repeatedly be stated to be important without critical re-assessment. A recent survey of substantial parts of western Dak Lak Province found no field evidence of big cats (Le Xuan Canh *et al.* 1997b) and there is no reason to assume that this area is atypical.

There are also recent indications from several areas extensive enough to support populations:

- Thanh Hoa Province (Pu Hu Nature Reserve);
- Binh Phuoc Province (perhaps Bu Gia Map Nature Reserve);
- Vu Quang Nature Reserve (Ha Tinh Province);
- An Khe District (Gia Lai Province);
- A Luoi and Phong Dien Districts (Thua Thien-Hue Province); and
- Kon Plong District (eastern Kon Tum Province).

The selection of Vietnamese Tiger sites supplied to Nowell and Jackson (1996) lacks obvious rationale; several are so small and disturbed that chances of them holding Tigers into the future are remote, if they even hold them now.

Lao

Tigers formerly inhabited all Lao provinces (Deuve and Deuve 1962) and recent surveys indicate that they still live in most. Persistence in National Biodiversity Conservation Areas like Xe Bang-Nouan, which is small, degraded and encircled by human settlement and cultivation suggests that Tigers are still scattered nationally almost throughout remaining forest. However, densities are greatly below natural ones, even in the centre of large wilderness areas. Five areas have particular potential:

- Nakai-Nam Theun NBCA-Nam Kading NBCA-Hin Namno NBCA-Khammouan Limestone NBCA and the rest of the Nam Theun basin;
- Xe Pian NBCA-Bolaven Plateau-Dong Ampham NBCA-Xe Kong basin;
- Phou Loey-Nam Et NBCAs;
- Nam Kan proposed NBCA (not yet surveyed); and
- Nam Phoun NBCA.

Much of the favoured lower-lying riverine habitat in the first lies outside designated NBCAs (e.g. Nam Theun Corridor) and even outside proposed ones (the Nam Hinboun plain and most of the Nakai Plateau). Tiger numbers and breeding success tend to be higher at lower altitudes (sect. 5.2) and the viability of Tiger populations if

they were confined to the hill ranges of these NBCAs, in the event of these lower-lying areas being lost, is unclear.

Cambodia

A 1997 country total for Cambodia of 100-200 was, by implication, a guess (Jackson 1997). Trade levels are high (Martin and Phipps 1997, Wikramanayake 1998) and Cambodia clearly retains many Tigers. Nationwide interviews (Heng Kimchhay *et al.* 1998) suggest that Tigers still occur at low densities across most of the northern half and western third of the country, with concentrations in:

- Kravanh Mountains;
- Keo Sema District (Mondulkiri Province); and
- Virachey National Park.

In some areas, Tiger status seems unhealthy: not one sign was found in an extensive survey of streams and pools in much of Ratanakiri (outside protected areas) and eastern Stung Treng Provinces in late dry season 1998 (Timmins in press.).

Yunnan Province, China

Yunnan formerly supported three recognised subspecies of Tiger. In the northeast lived *P. t. amoyensis*; in the west, *P. t. tigris*; and across most of the province north to 26°N, *P. t. corbetti* (Wang Yingxiang verbally 1998). However, Kitchener (in press) re-examined Tiger morphology and found that most variation is clinal and there is little evidence for discrete subspecies. Analysis of genetic variation (Cracraft *et al.* 1998) found no fixed diagnostic characters between the named mainland races. This supports Tan Bangjie's (*in litt.* to P. Jackson, about 1984) view that the subspecies in the border areas of China were never clearly identified.

There have been no records from northeast Yunnan since the 1950s or from the Burmese border area since the 1980s and they are presumed extinct in these areas (Wang Yingxiang verbally 1998, specifically *contra* Ma Yiqing *et al.* 1997), although occasional wanderers may yet occur. Tigers are now restricted in Yunnan to the southern border region, with perhaps 15-20 remaining; the estimate by Ma Yiqing *et al.* (1997) of 30-40 is certainly optimistic (Wang Yingxiang verbally 1998, Jiang Wang Gao verbally 1998).

The Yunnan population extended to southwestern Guangxi, but the suggestion that they persist (Ma Yiqing *et al.* 1997) seems outdated (Wang Yingxiang verbally 1998).

The tiny numbers remaining in Yunnan reflect past Chinese government payment of a bounty for every Tiger killed; only in 1977 was Tiger killing made illegal, and despite this, killing continued at a high rate (Lu Houji 1987).

Regional

Identification of areas with important numbers is possible only in Lao and Cambodia. These countries clearly support considerably more Tigers than do Vietnam or Yunnan Province, where, however, there is an almost complete lack of

detailed, up-to-date information based on field survey rather than local reports.

3.1.2 The current status of Asian Elephant in Indochina (Fig. 2)

Asian Elephant is the most completely surveyed of the focal species. Signs are distinctive and obvious. Most surveyors are in the field in the dry season and can find recent signs, while wet season prints can sink so deep that they remain throughout the following dry season. The distinctiveness and cultural and economic significance of the species mean that local information is usually readily interpretable.

In several areas (e.g. Nam Kan proposed NBCA, Lao), elephants occupy a small proportion, meaning that they could be overlooked by rapid assessments (see sect. 4.2); further sites may yet be discovered.

Vietnam

In 1984, 1500-2000 Vietnamese wild elephants were estimated, but some data used were a decade old (Do Tuoc 1991). Pfeiffer's (1984) suggestion that "wild herds are increasing owing to the war's end and the prevention of killing" was optimistic. By 1992, animals remained in three areas:

- northern provinces of Lai Chau and Son La;
- northern Annamites from Thanh Hoa to Quang Binh Provinces; and
- Annamite foothills of the Hai Van pass across the Tay Nguyen Plateau to Dong Nai Province.

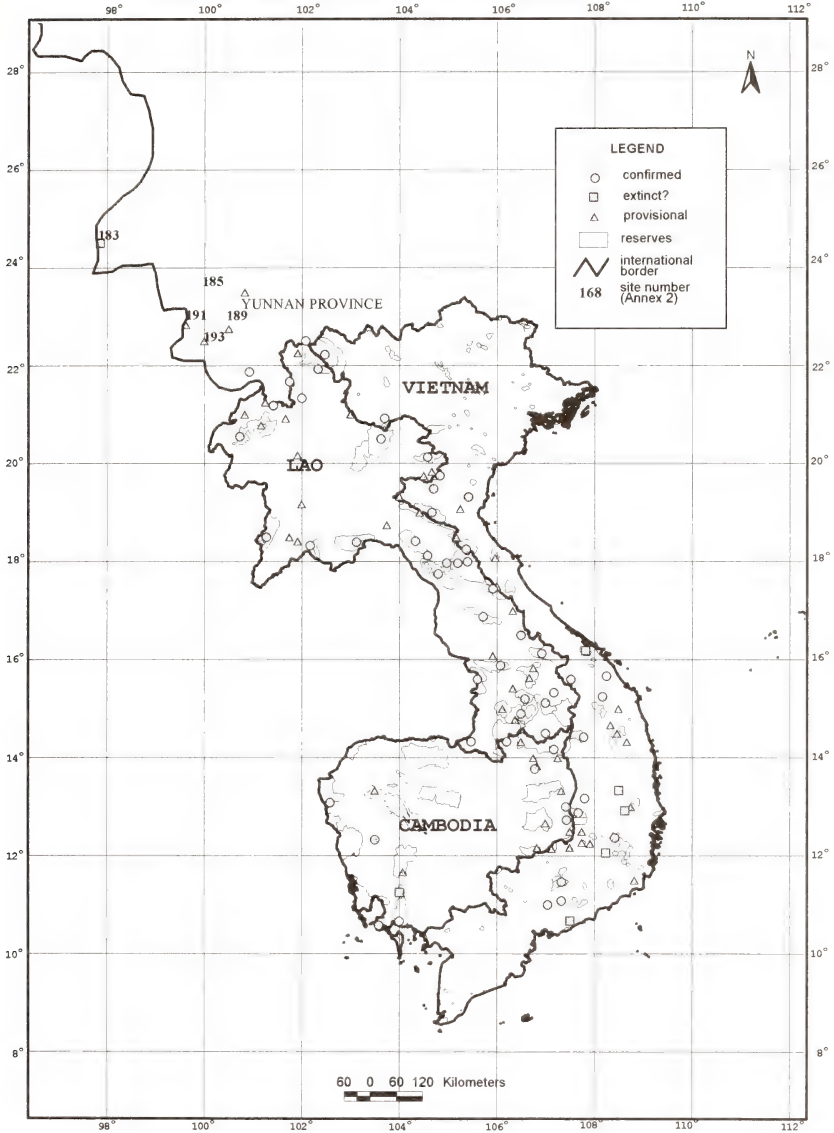
In historical times the species inhabited mountainous areas across the country (Le Vu Khoi and Do Tuoc 1992), and even this was an artificial restriction caused by high human population density in the lowlands. Earlier this century, the Central Highlands of Vietnam was the biggest Asian Elephant market in South-East Asia (Pfeiffer 1984).

A 1995 re-assessment set the national population at 200-230 (Do Tuoc and Le Trong Trai in prep.). The total of 300-600 (no derivation given) estimated by S. Dawson and Pham Mong Giao in Lair (1997) is implausibly large. Reports gathered from provincial sources by the national Forest Protection Department during 1997 suggested about 500 Asian Elephants in Vietnam, but past field checking of some reports shows that they are generally over-estimates; a better suggestion would be that many fewer than 200 wild elephants remain (Pham Mong Giao verbally 1997).

Do Tuoc and Le Trong Trai (in prep.) used provincial sources to suggest a national population as low as 165-179 individuals, with a dangerously dispersed distribution. This figure does not include some herds for which there is recent evidence (e.g. Binh Thuan Province), but their conclusion that Asian Elephant will become extinct in Vietnam without speedy implementation of specific measures is not changed by this. J. Walston (verbally 1998) considers even these figures too large and estimates the national total to be 75-150.

Numbers potentially important nationally may remain in:

DISTRIBUTION OF ELEPHANT IN INDOCHINA



- Pu Hoat proposed Nature Reserve, Pu Huong and Pu Mat Nature Reserves (Nghé An Province);
- Vu Quang Nature Reserve (Ha Tinh Province);
- western Quang Nam Province;
- Kon Plong District (Kon Tum Province);
- western Dak Lak Province;
- Tan Phu and Cat Tien National Park (Dong Nai and adjacent provinces); and
- Bien Lac-Nui Ong Nature Reserve (Binh Thuan Province).

Other areas may retain small numbers but chances of finding any unsuspected numbers over a dozen seem remote. Even at the sites listed, animals are under permanent high pressure, and some may already have lost their elephants.

Most listed sites are along the western national border and Vietnamese populations may have persisted through exchange with Cambodia and Lao, with elephants even crossing the Annamite crest.

Lao

Forestry workers reported 15 years ago that Asian Elephants were still widespread in southern Lao but scarce in the north following the activities of shifting cultivators (Sayer 1983b). Subsequent surveys show that animals still inhabit much of the country, including the north, although numbers in certain National Biodiversity Conservation Areas are too small to be viable (e.g. Phou Xiang Thong and Dong Hua Sao). A country total of 200-500 animals (no derivation given; A. Rabinowitz in Lair 1997) is much too low: Boonratana (1997) estimated 350-500 in Nam Phoun NBCA alone.

Areas of high importance include:

- Nam Phoun NBCA-Pa Sak Xaignabouli;
- the Nam Theun catchment, particularly the Nakai Plateau, the Nam Theun Corridor proposed NBCA, the fringes of Khammouan Limestone NBCA and some currently unprotected areas;
- Nam Xam NBCA;
- Sangthong District-Phou Phanang NBCA;
- Phou Khaokhoay NBCA;
- Phou Xang He NBCA;
- Dakchung Plateau-Phou Kathong proposed NBCA-Nam Ghong Provincial Protected Area;
- Xe Pian NBCA;
- Dong Khanthung proposed NBCA; and
- Xe Sap NBCA (provisionally).

The first two are clearly of outstanding importance. Most other NBCAs support small numbers and Asian Elephants persist even in some areas seeming unlikely to retain such a valuable animal, e.g. Xe Bang-Nouan NBCA which is small, degraded and

encircled by human activity.

There is little information on sex ratios. Ivory poaching may skew markedly sex ratios, in turn lowering population viability (Poole and Thomsen 1989, Sukumar 1989, 1993, Kurt *et al.* 1995, Menon *et al.* 1997). Many more males than females seem to be poached in Lao, indicating that ivory is sought primarily rather than skin or other products equally available from both sexes (K. Khounboline verbally 1998).

Cambodia

Chan Sarun (1992) stated that Asian Elephants inhabited four main regions:

- Kravanh (Cardamom) mountains;
- Dangrek mountains (on the northern Thai border);
- flatlands east of the Mekong; and
- plains around Tonle Sap lake.

This differs somewhat from the hypothesised strongholds in Santiapillai and Jackson (1990):

- along the western Thai-Cambodia border;
- mountains in the southwest of the country (e.g. Phnom Bokor National Park);
- northeast region (Mondulkiri and Ratanakiri Provinces); and
- southeast Kratie and Kompong Cham Provinces.

A national total of 500-1000 animals (no derivation given) was estimated by C. Santiapillai (in Lair 1997). The population was reported to Thouless (1987) to have been badly affected by land mines.

Preliminary results of an interview survey (Heng Kimchhay *et al.* 1998) indicate that the Kravanh Mountains retain an outstanding population of Asian Elephants. Keo Sema District (Mondulkiri Province) also seems to have important numbers. Elsewhere, Asian Elephants persist in only small, scattered numbers.

Of the areas suggested in other recent sources to support large numbers, Phnom Bokor National Park still retains animals, but large numbers do not persist widely in Ratanakiri and Mondulkiri (Olivier and Woodford 1994, Desai and Lic Vuthy 1996, Timmins in prep.); but for a chance aerial sighting of 30 in early 1995, there is no evidence of other than isolated animals outside Keo Sema. High levels of poaching and general lawlessness suggest that while numbers are still locally healthy, they are likely to be declining steeply.

Yunnan Province, China

Yunnan is the only Chinese province with recent records of Asian Elephant (Wang Yingxiang verbally 1998). In the 1960s-1970s elephants occurred in Yingjiang, Cangyuan and Jiangchung Counties and Xishuangbanna Prefecture (comprising Menghai, Jinghong and Mengla counties). They persist in all these except Yingjian County (MDYIZ 1976; Wang Yingxiang verbally 1998). The population may be growing slightly, with estimates for the 1970s of about 100, the

1980s of about 180 and the mid 1990s of 150-250 (Wang Yingxiang verbally 1998). However, there is long-standing uncertainty as to how many Asian Elephants live in Yunnan (Santiapillai and Jackson 1990 and references therein).

Nine elephants were poached in 1986, but the annual number killed fell by 1992, perhaps because of strict enforcement and combined gaol and fine penalties for those arrested and found guilty. In total, 20-30 were estimated as having been shot in the three years of 1994-1996 (Yu Changqing *in litt.* 1998); 40 were reportedly shot between 1992 and 1997 (Marsh 1997a). About 15 were killed in 1994, but the successful capture of some offenders and execution of 5-8 of them, and a gaol sentence for a further 20, appears to have been a stiff deterrent (Wang Yingxiang verbally 1998, Wu Zhaolu verbally 1998). Numbers are still large in regional terms, but they cannot stand this level of poaching indefinitely.

Regional

Lair (1997) quoted wild elephant numbers for each country, but these came from different sources and lacked transparent derivation. The figure for Vietnam (300-600) was unjustifiably large, and that for Lao (200-500) far too small. True figures are unclear, but the current population of Lao is many times that of Vietnam: elephants occur widely within many Lao National Biodiversity Conservation Areas, whereas in Vietnam numbers are tiny and fragmented. Such imbalanced figures could lead to poor conservation planning. Nobody has investigated regional elephant populations using repeatable and reliable methodology, so no commentator can place numbers on national populations.

Santiapillai *et al.* (1994) considered that elephant conservation "should rank the highest priority" in China, because of the small national population. Another reason adds further urgency: of the populations analysed here, only Yunnan's is claimed to be stable. The trend in Lao is equivocal. Nevertheless, Lao is the most important country of the four for long term elephant conservation, as it retains a good overall distribution with numbers healthy in several areas, has tracts of little settled land extensive enough for conserving entire annual ranges of elephant herds, and has been politically stable for the last two decades. Vietnam faces problems best admitted to be insoluble in maintaining anything other than symbolic numbers of wild elephants except perhaps along its borders.

There are a substantial number of elephants in captivity in parts of the region, for example in Dak Lak Province (Vietnam) and Xaignabouli Province (Lao). These elephants have mostly been taken from the wild populations. Their management is not treated here, but they do need to be addressed in conservation plans for the wild stock, for several reasons:

- Coming mainly from the wild, they may act as a drain on wild populations, but alternatively a continued need for collection might act as a spur to elephant conservation.
- Their signs may be encountered during survey work for wild elephants and confusion is possible (sects 3.2.4, 4.1.3, 4.2.1).
- Their ivory is trimmed and regulation of ivory possession and trading needs to

take due account of this (sect. 6.5).

- Use of tamed elephants is declining and surplus tamed elephants may be available for release into depleted wild populations or areas where local extinction has occurred (sect. 5.9).
- They may be of powerful use in educational programmes (sect. 6.7).
- Capture and use is often performed by certain families. If these activities decline, the needs of the mahouts should be addressed. They may be suitable people for use in wildlife protection activities.

3.1.3 The current status of Gaur in Indochina (Fig. 3)

Evaluating Gaur status was hampered by the difficulties of interpretation of local information and, for less experienced workers, the identification of signs to exclude Banteng and in some cases domestic cattle and even buffalo. The current summary assumes that where Gaur has been confirmed (e.g. by field sightings or examination of hunted remains) and there was no good evidence of Banteng, that wild cattle signs in the area reflected the status of Gaur.

Vietnam

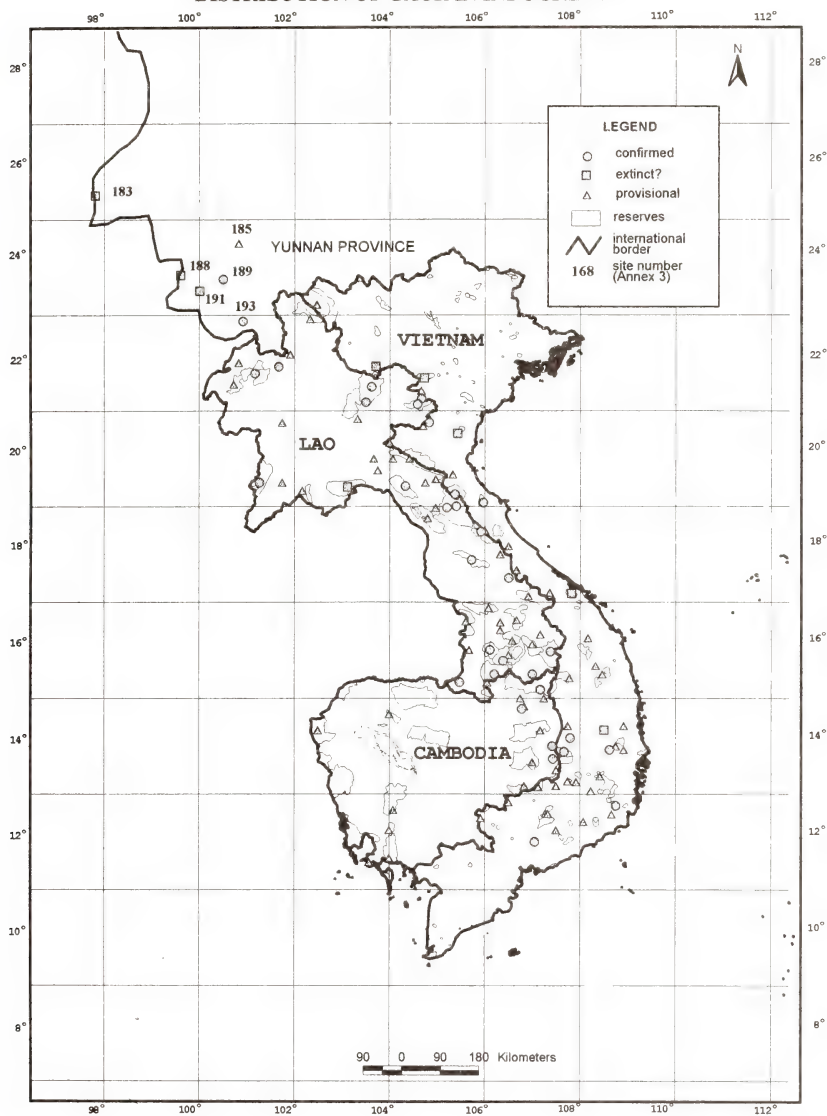
Byers *et al.* (1995) estimated that 1500-2000 lived in Vietnam, but by 1997 synthesis of information from provincial sources suggested that the national population was as low as 500; summing returned hunters' questionnaires gives 280 sites (Do Tuoc and Le Trong Trai in prep.) and while the same herd may be reported by several villages (Le Trong Trai verbally 1998), it is clear that in most sites numbers are dangerously small. The same questionnaires reported that 120 were killed during 1991-1995. If killing continues at this rate, Gaur will soon disappear from Vietnam.

Information on important areas is based largely on villagers' reports. The species remains more widespread in Vietnam than do Asian Elephant, Tiger or Banteng. Small numbers may persist in most of the larger forest blocks left, particularly along the Annamites and the Cambodian border or in forest linked to this area, but also in some isolated sites, notably Ea So (Dak Lak Province), Cat Tien National Park (Dong Nai and surrounding provinces) and the Da Lat Plateau (including Bi Doup-Nui Ba Nature Reserve and surroundings).

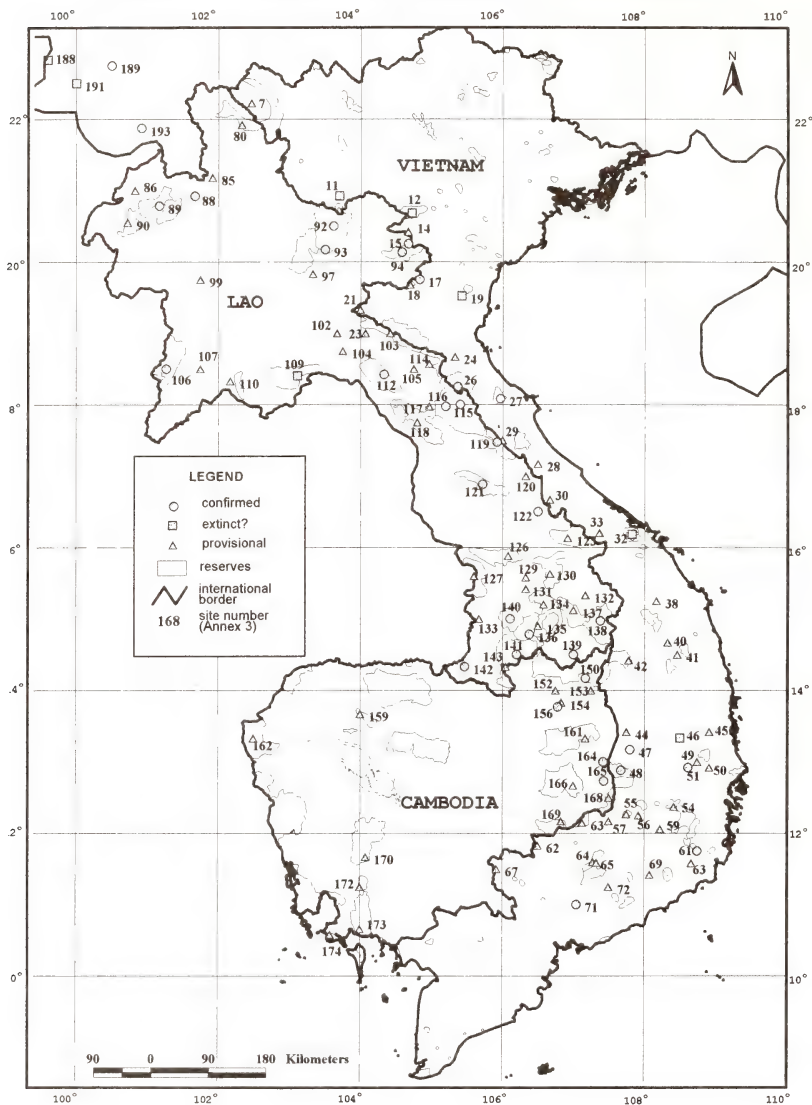
Sites perhaps important nationally are:

- Chu Mom Ray Nature Reserve (Kon Tum Province);
- Western Dak Lak-adjacent Gia Lai Provinces;
- Pu Mat Nature Reserve (Nghe Anh Province);
- Kon Ha Nung area (Gia Lai Province);
- west Quang Nam Province;
- Bu Gia Map Nature Reserve (Binh Phuoc Province);
- Vu Quang Nature Reserve (Ha Tinh Province);
- Phong Nha-Ke Bang Nature Reserve (Quang Binh Province);
- Pu Luong proposed Nature Reserve (Thanh Hoa Province);

DISTRIBUTION OF GAUR IN INDOCHINA



DISTRIBUTION OF GAUR IN CAMBODIA, LAO AND VIETNAM



- Dak Krong District (Quang Tri Province);
- Krong Trai Nature Reserve (Phu Yen Province); and
- Bien Lac Nui Ong Nature Reserve (Binh Thuan Province).

The first two are likely to be of greatest national importance. Mammals at some of these sites suffer heavy poaching and it is unlikely that all listed retain viable numbers of Gaur. In the absence of more precise and dated field information, no clearer picture can be produced.

Lao

An estimate of the Lao population as 1000 (Byers *et al.* 1995) seems to have been a guess. The long-term prospects of Gaur without specific active management may be healthier than for Asian Elephant: Gaur occur in several areas of evergreen montane forest (where human settlement and hunting are at low levels), and no cases of damaging human-animal conflict were traced with Gaur.

In most areas, Gaur appeared to live as isolated individuals or in herds of under six; this suggests populations are depressed as larger aggregations form in healthy populations (e.g. Hubback 1937, Wharton 1957, 1968, Schaller 1967, Pal and Guin 1986). Sites of apparently important numbers include:

- Nam Phoun NBCA-Pa Sak Xaignabouli;
- Nam Ha NBCA;
- the Nam Theun catchment, particularly the Nakai Plateau, the Nam Theun Corridor proposed NBCA, the fringes of Khammouan Limestone NBCA and some currently unprotected areas;
- Phou Xang He NBCA;
- Phou Lapeung sector, Dong Phou Vieng NBCA;
- Dong Ampham NBCA;
- Nam Ghong Provincial Protected Area (Attapu);
- Xe Pian NBCA; and
- Dong Khanthung proposed NBCA.

The first three are likely to be of overwhelming importance. The Sangthong area (Vientiane) and the Nam Xam, Hin Namno and Xe Sap NBCAs also may support important numbers.

Cambodia

Byers *et al.* (1995) estimated that 500-600 Gaur lived in Cambodia, in three sub-populations east of the Mekong and two west of it. Recent interview work (Heng Kimchhay *et al.* 1998) indicates that Gaur occur at low densities in the northern half and western third of the country, but are scarcer and less widespread than are Banteng. Virachey National Park seems to support the largest concentration. Keo Sema District (Monduliri Province) also seems important, but status elsewhere in Monduliri and Ratanakiri are not clear: footprints suggest that the species occurs locally in good numbers but a 1994 aerial survey found very few.

Yunnan Province, China

In 1995, a country population for China of 700-800 was estimated (Byers *et al.* 1995). Gaur live in China outside Yunnan only in southeast Tibet (Ma Yiqing and Wang Yingxiang 1995). All sites in Annex 3 (except Yingjiang) formed, until the 1950s-1960s, one large contiguous population. By the 1980s, the species was extinct in Lancang county, and the remaining animals were split into two populations: Xishuangbanna-Simao and Cangyuan (Wang Yingxiang verbally 1998).

Regional

All the countries retain scattered small numbers of Gaur; a regional overview is difficult without additional information.

3.1.4 The current status of Banteng in Indochina (Fig. 4)

Surveys often assign ambiguous cattle signs and information to Gaur except in likely Banteng habitat and this practice may under-estimate the current status of Banteng.

Vietnam

In 1990-1993, 200-300 Banteng were estimated for Vietnam, primarily by using villagers' estimates. The species was previously more numerous and widespread (Le Vu Khoi 1995, verbally 1998). Do Tuoc and Le Trong Trai (in prep.), using a similar technique, suggested that the national population was as low as 170-195 individuals, with a strong ongoing decline.

Former high densities (see Wharton 1957, 1968) are now much reduced and indeed extinction of Banteng in Vietnam seems imminent; e.g. Yok Don National Park clearly held important numbers until recently but these have dropped severely. There is recent evidence of herds in:

- Northwest Dak Lak Province-southwest Gia Lai Province;
- Cat Tien National Park (Dong Nai and surrounding provinces);
- Ea So proposed Nature Reserve (Dak Lak Province);
- Ninh Son District (Ninh Thuan Province); and
- Krong Trai Nature Reserve, Phu Yen Province (provisionally).

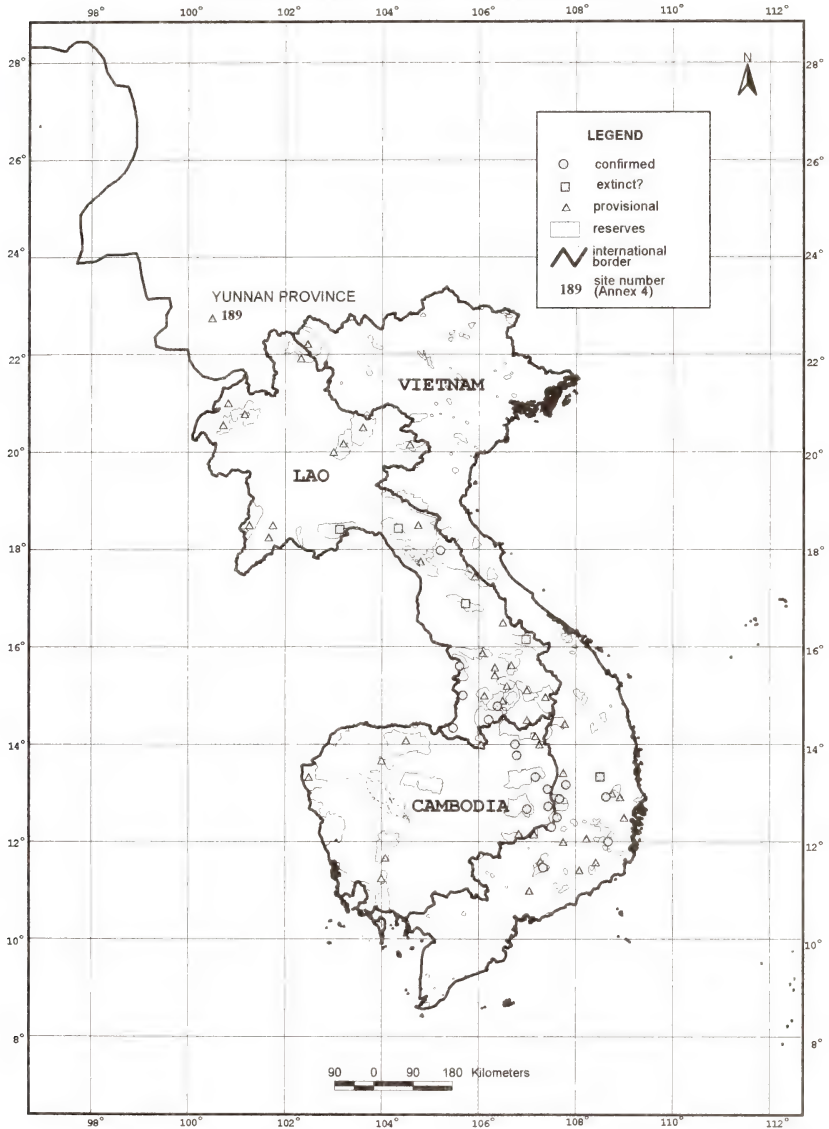
All areas are in the south, where open deciduous forest (usually believed to support the highest densities) is widespread. The important Ninh Son area and much of western Dak Lak remain unprotected.

Lao

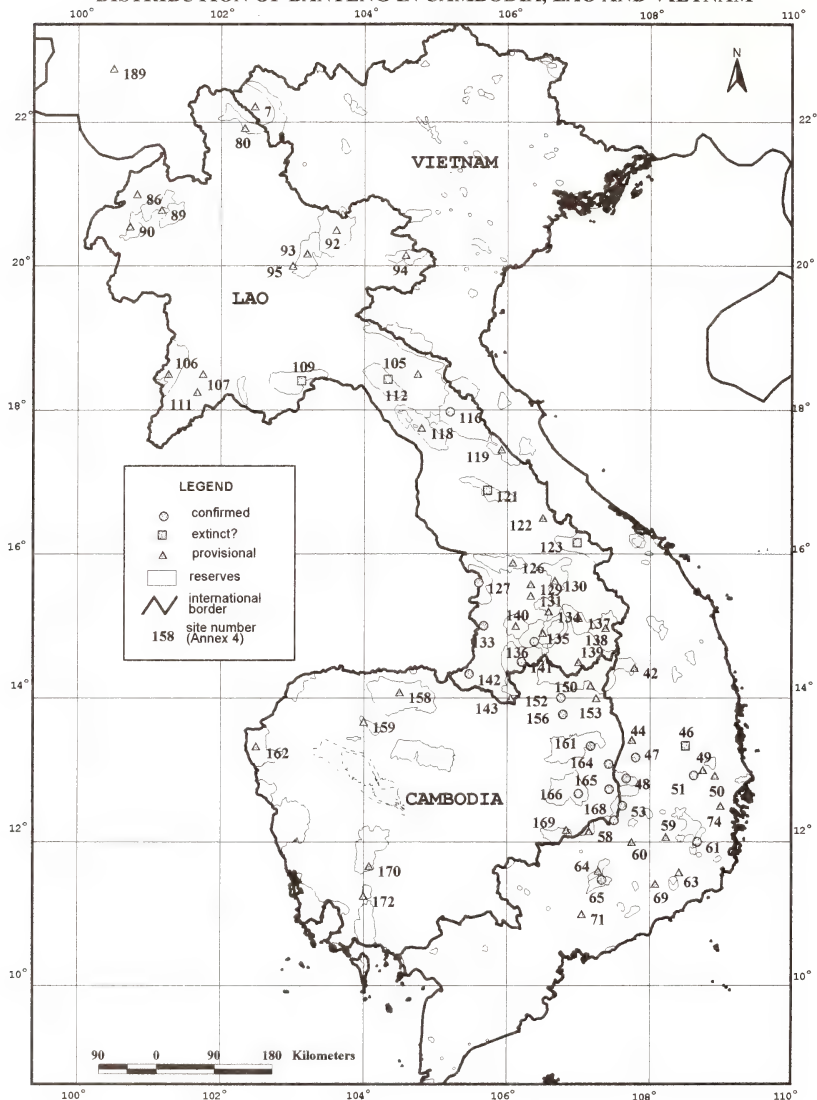
A suggestion that 500-1000 Banteng occur in Lao (S. Srikosamatara and B. Liphuong pers. comm. in Byers *et al.* 1995) is a guess. Concentrations are now restricted to a few key sites in the south of the country:

- Phou Xiang Thong National Biodiversity Conservation Area;

DISTRIBUTION OF BANTENG INDOCHINA



DISTRIBUTION OF BANTENG IN CAMBODIA, LAO AND VIETNAM



- Nam Ghong Provincial Protected Area;
- Dong Kalo (Xe Pian NBCA); and
- Dong Khanthung proposed NBCA.

The last is probably the most important. Interviews in the late 1980s indicated a wide distribution across the southern third of Lao, but numerous recent surveys there indicate that even in some areas of extensive suitable habitat, populations are now very thin (e.g. Xe Kong plains, Dong Ampham NBCA and proposed NBCAs on and adjacent to the Bolaven Plateau). The trading levels suspected by Srikosamatara and Suteethorn (1995) indicated that rapid decline in numbers and range during the 1990s was to be expected.

Widespread reports from the northern two-thirds of Lao, supported by a single fresh skin in the Ban Lak (20) market in 1995, indicate that scattered individuals may persist in the Annamite foothills and perhaps northern Lao; the possibility of discovery of a population of major importance should not be dismissed.

Cambodia

In 1995, 700-1000 Banteng were estimated in Cambodia (Sun Hean pers. comm. in Byers *et al.* 1995). Interviews (Heng Kimchhay *et al.* 1998) indicate that Banteng live at low densities across most of the northern half and western third of the country. Keo Sema District (Mondulkiri Province) seems to have important numbers, but status elsewhere in Mondulkiri and Ratanakiri is unclear. Although aerial survey of Mondulkiri in 1994 found the species over much of the east, numbers may have dropped substantially in the intervening four years and a recent extensive survey of suitable habitat in Ratanakiri found only one set of prints (Timmins in prep.). It is likely that the critical situation for the species in Vietnam and Lao will soon pertain to Cambodia.

Yunnan Province, China

Banteng was first reported for China by Wang Yingxiang (1987); this source accidentally listed Xishuangbanna. The true site is Zulin, which remains the only area with claims. Local people in Xishuangbanna consistently report two forms of wild cattle, but no evidence of Banteng has been forthcoming (Wang Yingxiang verbally 1998) and the cautions in sect. 3.2.4 should be considered here. Pending further confirmation of the species, W. V. Bleisch (*in litt.* 1998) feels that the species should be considered to be extirpated from China, while Wang Sung (*in litt.* 1998) feels that until there is a publicly accessible specimen with unambiguous locality data, Banteng should not be considered as having occurred in China.

Regional

The extensive suitable habitat in Cambodia (e.g. Pfeffer and Ou Kim San 1967), much of which remains little settled and little farmed, suggests that Banteng numbers may be higher there than elsewhere in the region. Nevertheless, even here densities are greatly depressed and, in combination with the dire situation in Lao and Vietnam, it is clear that Banteng is the most imminently threatened of the focal species.

Historically, Banteng certainly lived at high density across much of Cambodia, the Mekong plains and adjacent foothills of Lao south of the Nam Kading, and southern Vietnam, especially the lowland parts of the Tay Nguyen Plateau. Reports from northern Indochina suggest that it may have a wider distribution, especially as there are historical reports from these areas (McNeely 1975). F. R. Wulsin (in Osgood 1932) apparently collected a calf in Lao (no locality, but he worked only north of Vientiane) and a single animal in Lai Chau (the northwesternmost province in Vietnam), but the possibility that these animals came in trade cannot be dismissed.

It is thus difficult to interpret the various recent claims of Banteng from the north of the region. As, apart from that in Yunnan, they are based entirely upon external surveyors setting species names to local reports, it seems prudent to regard them as unconfirmed.

3.1.5 Notes on the status of Asian Tapir, Kouprey, Asian Buffalo and rhinoceroses in Indochina

No conclusive evidence of extant Asian Tapir, wild Asian Buffalo or Kouprey in Indochina was found. All reports traced on them, and on rhinoceroses, were forwarded to the relevant IUCN/SSC specialist group; a summary is given below.

Rhinoceroses

The Javan Rhinoceroses in Cat Loc Nature Reserve, southern Vietnam are well publicised (Schaller *et al.* 1990, Vo Than Son 1991, Haryono *et al.* 1993, Santiapillai *et al.* 1993, Anon. 1995b, van Strien 1998).

Scattered individual rhinoceroses seem to have survived in at least Lao and in Vietnam away from Cat Loc into the 1980s with perhaps a few into the 1990s (Dang Huy Huynh *et al.* 1980, Salter and Phanthavong 1990, Salter 1993a, 1993b, Berk Müller *et al.* 1995a, Schaller 1995, Nhiet Thorn and Be Seng Leang 1996, Schaller and Bounsou 1996, Davidson *et al.* 1997, Schaller 1997a, 1997b, Tizard *et al.* 1997, Wikramanayake and Dillon 1997, WWF/Burapha 1997, W. G. Robichaud verbally 1998). Chances of discovering another extant rhinoceros populations in Indochina are fading; any remaining animals are permanently at risk of being killed.

Asian Tapir

There were no recent reports of Asian Tapir. Patte (1928) discusses sub-fossil tapir remains from Tonkin, but historical evidence of the species in the region seems ambiguous. It will be synthesised elsewhere when all sources have been traced; several are rather recondite, e.g. a 1976 newspaper article by Hoang Quoc Truong cited in Tran Hong Viet (1990). Tapirs shipped from Lao, presumably in the 1960s and early 1970s, were probably illegal re-exports from Thailand (McNeely 1975). In 1997 a report was received by the Vietnamese Forest Protection Department of tapirs but a visit to the area deduced that the animal was a young elephant with dried mud on its back (Pham Mong Giao verbally 1997). Do Tuoc and Le Trong Trai (in prep.) concluded that tapirs do not occur today in Vietnam.

Asian Buffalo

Confusion over distinguishing feral (i.e. free living animals descended from domestic stock) from truly wild animals clouds the current status of Asian Buffalo. Wild individuals may persist locally in Indochina, mainly in the south (Sayer 1983b, Laurie *et al.* 1989, Salter *et al.* 1990, Cox *et al.* 1992a, Duckworth *et al.* 1993, Salter 1993a, Henning 1994, Berkmüller *et al.* 1995a, Byers *et al.* 1995, Chay Samith *et al.* 1995, Dang Huy Huynh *et al.* 1995a, 1997, Desai and Lic Vuthy 1996, Duckworth 1996b, Le Xuan Canh *et al.* 1997b, WWF/Burapha 1997, Heng Kimchhay *et al.* 1998, Wolstencroft in prep.); note that some of these sources conclude that the information did not refer to wild buffalo.

Do Tuoc and Le Trong Trai (in prep.) concluded that wild buffalos are extinct in Vietnam, while Pham Mong Giao (verbally 1997) considers that there may have been none for over 30 years. In much of the country (e.g. Son La, Lai Chau, Nghe An and Quang Binh provinces, and the Tay Nguyen Plateau), domestic buffalos are released for periods of up to nine months, being recaptured only for preparing fields for crops. Feral buffalo were widespread after the war, but most have been shot for meat (Pham Mong Giao verbally 1997).

Following up promising reports in Lao invariably indicates that even if wild-living buffalo persist, they are probably feral. There is no evidence of truly feral populations, as in herds of wild-living animals which are never caught by people. Undoubtedly such animals existed during the civic unrest of the last few decades, but it seems that most if not all have been rounded up or hunted.

From three areas in Cambodia hunters widely report wild buffalo: Siem Reap and Preah Vihear Provinces; Battambang Province; and Koh Nhek (Mondulkiri Province) (Heng Kimchhay *et al.* 1998). In one case, the hunter's claim to know two sorts of wild buffalo suggests that feral or domestic animals are involved, and no other report is particularly persuasive.

Kouprey

Recent evidence of Kouprey comes only from traders (e.g. La-Ong *et al.* 1997) and local reports; none gives conclusive proof of the species's survival (Dang Huy Huynh *et al.* 1980, Laurie *et al.* 1989, Cox and Ha Dinh Duc 1990, Salter *et al.* 1990, Tran Hong Viet 1990, Cox *et al.* 1992a, Dobias 1992a, 1992b, Salter 1993a, 1993b, Dioli 1994, Duckworth *et al.* 1994, Henning 1994, Olivier and Woodford 1994, Berkmüller *et al.* 1995a, Dang Huy Huynh *et al.* 1995a, Do Tuoc and Ngo Tu 1995, Le Vu Khoi 1995, Sun Hean 1995a, Desai and Lic Vuthy 1996, Nhiet Thorn and Be Seng Leang 1996, Robinson and Yem Sokhan 1996, Le Xuan Canh *et al.* 1997b, WWF/Burapha 1997, Heng Kimchhay *et al.* 1998, Do Tuoc and Le Trong Trai in prep., Wolstencroft in prep.). A possible sighting in Yok Don National Park in the late 1980s was in such poor light that even the sex could not be confirmed (Le Vu Khoi verbally 1997), although this sighting was seized upon by some journalists.

Le Xuan Canh *et al.* (1997b) underscored the difficulty of interpreting local reports by discussing an incident in which several senior Vietnamese scientists took a Kouprey report seriously, but later investigation (including examination of video footage) demonstrated that the animal was a bull Banteng. Round and

Vongkhamheng (1998) were also told of a 'Kouprey', which circumstantial details, and the evidence of another informant, showed was a Banteng.

Do Tuoc and Le Trong Trai (in prep.) concluded that Kouprey is extinct in Vietnam. This may well be so for Lao, but in Cambodia a few may yet survive (La-Ong *et al.* 1997, Lic Vuthy verbally 1997, B. Sakon verbally 1998, H. Weiler verbally 1998), both west and east of the Mekong: in Koh Nhek District (Mondulkiri Province) and the upper Taveng District (Virachey National Park), with perhaps small numbers in Siem Reap and Preah Vihear Provinces (Heng Kimchhay *et al.* 1998).

3.1.6 *Distribution of the focal species with respect to protected areas*

Most confirmation of the focal species came from protected areas. Caution is needed, however, in suggesting that protected area systems therefore protect most of the remaining animals, because surveys are more likely in them or where their declaration is a distinct possibility (see Thewlis *et al.* in press for Lao). To tell whether protected areas were appropriately sited, many surveys from unprotected areas would be needed, but few such documents were found. However, the general distribution of reports received by the government bodies CPAWM (in Lao) and FIPI (in Vietnam) from local people suggests few unprotected areas have large numbers of the focal species (Venevongphet, Do Tuoc verbally 1998).

Vietnam

The national protected areas system of Vietnam evolved piecemeal and most are rather small. After decades of war, it was impossible to declare areas big enough to protect the focal species, but now extension of the more important is a major goal (Nguyen Xuan Dang verbally 1998). The following discussion assumes that several proposed reserves will all be declared: Ea So (Dak Lak Province), Pu Luong and Pu Hu (Thanh Hoa Province) and Pu Hoat (Nghe An Province). A European Commission-funded project executed by FIPI with technical assistance from BirdLife International is evaluating the protected area system; the need for such national review is highlighted by recent discoveries of unprotected areas very important for the focal species, e.g. Ea So (Le Xuan Canh *et al.* 1997b).

Several areas perhaps important for the focal species seem not yet to have protected area status. These areas are:

- Chu Prong District (southwest Gia Lai Province) and the adjacent part of northwest Ea Sup District (Dak Lak Province) is within one of the five areas often stated to be most important for Tiger in Vietnam, has some wild Asian Elephants, supports significant numbers of Gaur and Banteng. If Kouprey and wild Asian Buffalo still occur in Vietnam, this is perhaps the most likely area for them.
- Ninh Son District (Ninh Thuan Province) was confirmed in 1997 to retain healthy numbers of Banteng: Gaur were also reported. The Phan Rang Nature Reserve, in Ninh Hai District, does not cover the wild cattle habitat (Le Trong Trai verbally 1998).
- Ninh Phuoc District (Ninh Thuan Province) was recently reported to hold Asian

Elephants and Gaur.

- Various parts of Quang Nam Province retain small numbers of Asian Elephants and probably Tigers and Gaur as well. The proposed Song Thanh-Dak Pring Nature Reserve does not cover all the relevant areas, which extend into Hien, Giang, Phuoc Son, Que Son, Tra My and Tien Phuoc Districts.
- A Luoi District (Thua Thien-Hue Province) has recurrent reports of Tigers.
- Kon Plong District (Kon Tum Province) has recent reports of Tiger, Gaur and Asian Elephant.

Lao

There were no nationally protected areas in Lao during the 1980s. The Lao-Swedish Forestry Co-operation Programme, initiated in 1988, includes a conservation component, the Forest Resources Conservation Project, executed with technical assistance from IUCN. In the first few years areas were identified for inclusion in a protected areas system, in systematic fashion (aerial imagery followed by ground reconnaissance). The first 18 National Biodiversity Conservation Areas (NBCAs) were legally declared in 1993. Since then several other areas have been proposed as NBCAs (e.g. Berk Müller *et al.* 1995a, 1995b); most remain ungazetted.

Landscape level areas were taken, meaning that if hunting were curtailed most could support the focal species indefinitely. NBCAs are akin to multiple-use areas (IUCN category VIII; see McNeely and Miller 1984); only small parts of each are likely to be given 'no-use' designation (C. Inthavong verbally 1996). Since focal species conservation depends on such core zones (sect. 5.10.3), and core zones have not yet been assigned in most NBCAs, the potential of the Lao protected area system to conserve the focal species cannot be assessed.

Only two areas seeming to be important for the focal species seem not to have been considered for national protection:

- Viengthong District (Bolikhamxai Province) which is reported to hold wild cattle and Tigers; and
- Western Phongsali Province, which reportedly holds many Asian Elephants, jointly with Mengla (Xishuangbanna National Nature Reserve, Yunnan Province). The habitat in this area of Lao is poor (D. Hulse verbally 1998; but see sect. 3.1.7).

Several areas considered for protection but now rejected apparently support the focal species. Dong Khanthung, at one stage dropped, was reinstated as a proposed NBCA at least partly for its large mammal populations (Berk Müller and Vilawong 1996, Timmins and Vongkhamheng 1996b). Designation of further areas for NBCA status is possible, particularly if they can be considered an extension to an existing area (Venevongphet verbally 1998). The following areas may be important for the focal species:

- Houay Nam Loy (Louang-Namtha Province), Pa Sak Xaignabouli (Xaignabouli Province), Tha Teng (Salavan Province), Nam Ghong (Attapu Province) and the

Xe Bang Fai Headwaters (Khammouan / Savannakhet Provinces) all reportedly support Asian Elephants, Tiger and wild cattle (Annexes 1-4). For at least some of these, notably Pa Sak Xaignabouli, the reason for rejection appears to have been the severe degradation of the forest cover (Salter *et al.* 1991: 5); however, this does not necessarily mean the area is valueless for the focal species (sect. 5.2).

- Nam Khang area (Phongsali Province) may be an important link with Yunnanese Asian Elephant populations and habitat is good (C. W. Marsh *in litt.* 1998).
- Tiger and Asian Elephant still occur on the Dakchung Plateau on which lay the former Xe Kong Pine Forest proposed NBCA (Xekong Province).

Some areas peripheral to the established and proposed NBCAs are important for the focal species:

- Parts of the Nam Hinboun plain and much of the Nam Theun between Khammouan Limestone NBCA, the Nakai Plateau and Nam Kading NBCA (a greater extent than the currently proposed Nam Theun Corridor). Tigers, Asian Elephants and Gaur all use these areas and they are vitally important as corridors for the animals in the three main areas (see Timmins 1997).
- The Asian Elephant and probably the wild cattle range west of Vientiane includes Phou Phanang NBCA but important areas are unprotected (e.g. northern Sangthong District).

Cambodia

A national protected area system for Cambodia was reconstructed in the early 1990s. Landscape level areas were proposed from a national perspective. Most were identified aurally. Ongoing security uncertainties mean that there is little information on their wildlife and little opportunity to isolate important areas omitted from the protected area system. However, the extensive dry dipterocarp forests of eastern Monduliri and southern Ratanakiri provinces are not well represented in either Virachey National Park or Lomphat Wildlife Sanctuary, meaning that important numbers of Banteng remain under-protected. The area also holds Tiger, Gaur and Asian Elephant and possibly relict numbers of Asian Buffalo and Kouprey. The O'Tang-O'Leo provincial protected area in southeast Ratanakiri covers part of this area but the Keo Sema District (Monduliri Province) is apparently unprotected.

Yunnan Province, China

The protected area system in Yunnan is under review and a complete list of all gazetted areas, national and provincial, was not traced. Xishuangbanna National Nature Reserve, the flagship protected area of the province, is formed of five discrete reserves (Mangao (east of the Mekong), Mengyang, Menglum, Mengla and Shangyong) with human settlement and agricultural land in intervening areas; each is, in view of its isolation, referred to hereafter as a parcel, as sectors and other terms for regions of a protected area are usually contiguous. The four parcels east of the Mekong support more important focal species populations than does the one to the west. The only area in the province evidently important for focal species and possibly

unprotected is Jiangchung County, where large numbers of Asian Elephants were reported.

3.1.7 *Distribution of focal species with respect to Tiger Conservation Units*

Dinerstein *et al.* (1997) demarcated Tiger Conservation Units (TCUs) for most of the Tiger's range, although China was not covered. Major determinants were: area size, habitat fragmentation / contiguity, habitat degradation and the presence of "effective" protected areas. To this was added low-weighted information on poaching levels and Tiger status. For Indochina, "effective" protected areas seems to mean declared. To interpret the following section, readers will need to refer to a copy of Dinerstein *et al.* (1997); the summary given in Wikramanayake *et al.* (1998) is not detailed enough for site-specific discussion.

Explicitly, TCUs are a maximal view of where habitat characteristics give long-term Tiger conservation potential. Tiger numbers in a TCU today may be very low or, theoretically, buoyant (depending on hunting levels). Current Tiger status was deliberately weighted low because with protection, and where the prey-base remains, Tiger numbers rise rapidly (e.g. Mishra *et al.* 1987). TCUs are a framework to direct Tiger conservation resources where success is possible. The next stages are to identify which TCUs retain important Tiger numbers and to prioritise areas within very large TCUs.

The analysis omitted all recent information on confirmed Tiger presence from Indochina. Poaching pressure and Tiger status were, however, assessed for each site, although many have never been visited by biologists. Most Indochinese TCUs received rather similar values for poaching pressure and Tiger status respectively, and as these categories were weighted low, mistaken assessments for them affect regional prioritisation little. Most Indochinese sites were flagged for future survey (p. 66): the two exceptions, Louangphabang and Muang Xaignabouli (Lao), lack obvious rationale and indeed fig. 5 of the same document lists them both as priority survey areas.

As TCUs are fundamentally a habitat / hunting level classification, not a statement about contemporary Tiger populations, they serve as a basis for Asian Elephant and Gaur conservation, as these three could occupy most forest habitats in the region. Banteng Conservation Units could be mapped with reinterpretation of habitat to reflect the species's narrower habitat use (sect. 5.2; see below).

In general, TCUs were a fair predictor of where surveys have found or reported the focal species. As most surveys reviewed here were executed or planned before the TCU analysis was undertaken, there is clearly no risk of circularity of results as described for protected areas (sect 3.1.6). However, both TCU analysts and wildlife survey planners prioritised areas with respect to habitat extent, meaning that a good correlation of TCUs with known focal species populations is likely: few areas of disrupted and fragmented habitat have been included in either survey programmes or TCUs. As no empirical evidence suggests that such areas are important to any focal species, such patchy coverage is unlikely to spawn important errors of interpretation.

The major importance of TCUs 99 and 113 were supported; too little information was available to assess TCU 122 (indeed much of TCU 113 remains unknown).

TCUs lacking evidence of importance to focal species

There are approximately 40 TCUs in Indochina; for over 20 confirmation is lacking of their importance for any focal species. No reports were traced for most and it is thus not possible to judge their importance for large mammals. Even where a report was found, survey work was rarely comprehensive enough to state that Tigers or any focal species were absent.

Most of these TCUs are small and low priority (level 3): 84, 85, 86, 87, 88, 89, 91, 92, 94, 96, 97, 103, 105, 109, 112, 115, 116 and 119. TCU 93 is slightly bigger and is at level 2. Most are surrounded by cultivation and settlement. TCUs 82, 83 and 90 are listed as priority survey areas; no relevant information was found during the present review. The paucity of survey work in the small TCUs prevents assessing whether, as seems likely, small TCUs are much less likely to retain the focal species than are big TCUs.

Only one large TCU lacks confirmation of the presence of the focal species in its Indochinese part: TCU 73. However, it extends only marginally into Lao from Thailand, and Tigers are confirmed in it outside Lao (Rabinowitz in press). If focal species can cross the Mekong here, this may contribute to the reportedly high numbers in Nam Kan proposed NBCA, which almost abuts the TCU.

Several further TCUs appear to retain some focal species, but there is no recent evidence of Tigers: TCUs 111, 117 and 118.

Potentially important numbers of focal species outside TCUs

Two classes of area not categorised as TCUs where focal species persist are evident:

1. Extensive, variably degraded, evergreen forest interspersed with scrubland:

- Muong Nhe Nature Reserve, Lai Chau Province (Vietnam) / Phou Dendin NBCA (Lao);
- Nam Ha NBCA / Nam Kan proposed NBCA / Houay Nam Loy, Lao;
- Nam Et / Phou Loeyu NBCAs, Lao;
- Pa Sak Xaignabouli, Lao;
- Sangthong / Phou Phanang NBCA, Lao; and
- Dong Phou Vieng NBCA, Lao.

Five of these six complexes lie in north Indochina, reflecting more extensive habitat degradation there than in the south, resulting from long-standing difference in agricultural practices (see e.g. Salter 1993a). This is reflected in the TCU process (Dinerstein *et al.* 1997: fig. 5) which identified few TCUs, all small, in Indochina north of 19°N.

The omission of these areas from the TCU process needs rectification. Nam Et / Phou Loeyu may be one of the most important areas for Tigers in Lao, two other areas (Nam Ha etc.; Sangthong etc.) are important for at least some focal species, and the value of Muong Nhe / Phou Dendin is unclear. Pa Sak Xaignabouli was dropped from the list of proposed protected areas in the early 1990s, but its proximity to Nam

Phoun suggests that whatever the habitat it would be a valuable buffer to the large and highly important Asian Elephant, Gaur and Tiger numbers of the latter.

Of these sites, only Dong Phou Vieng National Biodiversity Conservation Area lies in southern Indochina. It was severely and extensively damaged during armed conflicts in the 1960s and 1970s and habitat has not yet regenerated. However, much of the area is remote from villages and therefore it supports good populations of quarry species, including some of the focal species (Steinmetz 1998a).

2. Open forest / grassland areas, including:

- Krong Trai Nature Reserve and Song Hinh District (both Phu Yen Province);
- Phou Theung proposed NBCA (Lao); and
- Phou Kathong proposed NBCA (Lao).

Natural habitat over substantial parts of these areas, all in south Indochina, comprises open deciduous woodland, e.g. dry dipterocarp forest. These habitats often have low, open woody vegetation and some superficial physiognomic resemblance to scrub; they seem to have been mistaken for degraded areas. Additionally, much of the Xe Kong plains (in and adjacent to Xe Pian NBCA) supporting dry dipterocarp forest were also classified as degraded forest, and TCU 118 was identified for its tropical moist deciduous forest; however, habitat in the area important for ungulates (and thus indirectly for Tigers) includes extensive grassland and open scrub woodland (Le Xuan Canh *et al.* 1997b), which is represented as cleared.

Notably all these sites hold, at least reportedly, Banteng, a species strongly associated with such habitats. All reportedly to hold other focal species including Tigers.

Refinement of TCU process

Two classes of areas important for focal species are thus excluded from TCUs because data indicated, reliably with the first, misleadingly for the second, that habitat was degraded (Dinerstein *et al.* 1997: fig. 3). Yet Tigers and their ungulate prey do not eschew degraded forest, scrub and grassland: indeed, densities seem higher in such habitats than in the climax closed-canopy evergreen forests naturally over much of Indochina (sect. 5.2).

Habitat was perhaps selected as a primary predictor of Tiger distribution as its condition is a good indicator of long-term human use in the area. The presence of areas recovering from war-related effects and abandonment of shifting cultivation means that habitat condition may not be the best indication of current human usage, at least in Lao. By contrast, pressure on land in Vietnam is so high that many areas deforested during the war have been subsequently preferentially settled (J. C. Eames verbally 1998). Notably, the TCU process seems to have given better results for Vietnam; only one site in the list of degraded areas is in this country, and only partially so.

For all focal species including Tiger, people travel deep into remote areas to hunt them. A major determinant of where they go is accessibility: easy travel (e.g. on a

navigable stream or a track) is preferred over an energetic walk over difficult terrain. In the absence of a specific need to the contrary, there is also a strong disinclination to spend nights away from villages, meaning that areas more than half a day's journey away are much less visited than areas within this distance (Lao: Berkmüller *et al.* 1993; Cambodia: D. Ashwell verbally 1998).

Hunting focal species is one reason why people will enter difficult areas and spend nights in remote forest, but even so accessible areas are preferred. Therefore, if for TCU definition habitat were weighted by accessibility (distance from settlements, river navigability and general terrain), a predictive assessment of where to conserve Tigers would be more accurate than one based upon condition.

3.2 Limitations of the analysis

Many factors reduced the utility and / or credibility of reports. These issues, although some are unseemly, bear clearly on data interpretation and on recommendations for future survey and reporting (Part 4). As information from Yunnan Province was not reviewed in detail, this section concentrates on Vietnam, Lao and Cambodia.

3.2.1 Uneven geographical coverage

There is little information from all but a few Cambodian sites. In particular, no field information is available on wildlife status from the west of the country, from Phnom Aural west to the Thai border and northeast to the inflow of the Mekong to Cambodia (Chay Samith verbally 1998). Comparing Vietnam with the other countries is hampered by the low standard of reports (sects 3.2.5-3.2.7). Lao has been well covered recently, but even here more information is needed, even from National Biodiversity Conservation Areas which have had a general wildlife survey.

3.2.2 Lack of specimens

Interpreting the high volume of status information not validated by specimens is an increasing challenge. Specimens are open to external, objective validation (although not infallibly, as surveyors may fabricate locality and other information; see, e.g., Knox 1993), whereas sightings etc. are not: with the latter, acceptance of the survey findings is fundamentally an act of trust in the ability and veracity of the surveyor.

Overwhelming arguments for collection of small species remain (Reynolds *et al.* 1996), but wholesale declines in very large mammals mean that conservationists and biologists no longer desire specimens to validate records. Likelihood of misidentifying the focal species is low for sight records, but with indirect information the potential for error increases, especially when interpreting local reports (see sect. 3.2.4).

Assessment of records is eased if photographs of animals or their signs are taken. Measurements, and plaster casts or tracings on acetate, of footprints are the best specimens collectable today. Animal remains held by local hunters or others are useful only if their provenance is established; few records reviewed indicated whether

this had been done.

Reviewing the status of Bay Cat *Catopuma badia* in Borneo, Meijaard (1997) assigned a probability rating to each claim of the species, on a four-point scale from 'indication of occurrence in the area' to 'confirmed record'. Compiling this document convinced the authors that a quality indicator such as Meijaard's is needed in all status reviews collated from disparate sources, despite the dangers of personal alienation of the compilers. A simpler scheme, of confirmed / provisional, is adopted here; criteria for classification are given in sect. 2.3.

3.2.3 Poor quality fieldwork

Evidence indicating sub-standard fieldwork was widespread, particularly in Vietnam. Mammal species lists, and where the same personnel undertook bird work, bird lists, indicated surveyors' abilities and attitudes to identification. Some lists contained so many improbable species that the surveyors seemed to lack basic understanding of field guide use, interpretation of villagers' information, and elementary biogeography; readers are likely then to treat the entire report as factually suspect, particularly where deductions and extrapolations untenable on the basis of the data gathered are also made. Implausible lists were presented by at least some surveys in all three countries, with or without external technical assistance; some were funded by or through major international conservation organisations, including, among others, the WWF Indochina Programme, the sponsor of this report.

3.2.4 Interpretation of village information

Information from local people needs very careful interpretation. A reliable picture is rarely gained from a few opportunistic chats. Interviewing is as specialised a skill as field observation and getting acceptable results needs similar high levels of experience, commitment and intuition. Full review of the pitfalls inherent in interpreting local information, and strategies to overcome them, is beyond the scope of this document, but some general points can be made:

- Dated first-hand sightings from stated localities are more credible than responses such as "oh them, yes, there are plenty of them here!" (e.g. Thouless 1987, Rabinowitz 1993, Timmins and Evans 1996).
- Information gathered by people without fluency in the local language or dialect is of greatly reduced reliability (e.g. Duckworth 1997, Le Xuan Canh *et al.* 1997b; R. Steinmetz *in litt.* 1997); translators often have a weak understanding of key points.
- Except for very distinctive species (e.g. Asian Elephant, Black Giant Squirrel *Ratufa bicolor*) village nomenclatural units are rarely congruent with taxonomic species limits (e.g. Stearman 1992): gene-pools and units of evolution are of little practical relevance to rural people.
- There has been an almost complete lack of validation of this method, making it therefore unacceptable to the scientific community. Blind tests of local identification of known signs and remains, and the insertion of dummy photographs (e.g. a Jaguar *Panthera onca* among Indochinese cats) are rarely

performed. Only after scientifically rigorous tests of villager performance, using adequate sample sizes both of wildlife objects and people, will it be clear what level of confidence can be attached to local information; the level is likely to vary considerably between people and so it is likely that at each site several people should be questioned.

Informants occasionally mislead surveyors, usually for understandable reasons, but far more frequently errors arise accidentally; problems with using village information lie mainly with interpretation, not with the information itself. Bergmans (1995) discusses some fantastic tales about villagers' claimed exploits with Tigers. No surveyor would take such tales as fact, but knowing where to draw the line is difficult, as there is a continuum between the completely implausible and the entirely plausible.

A survey in Phou Xang He National Biodiversity Conservation Area (Lao) in 1993 apparently did not find the best areas for wild cattle, because local people suppressed them; it seems they felt that if the area's wildlife were known, poaching would become more difficult and punishments more severe. Conversely, people may exaggerate the wildlife importance of their area.

An informant claiming Kouprey to Desai and Lic Vuthy (1996) demanded advance payment before leading them to the area. Inhabitants of Ratanakiri Province (Cambodia) report being asked by Lao for a Kouprey photograph; they believe that they will be paid US\$500 for the picture, which will be used across the border to draw in foreign funding (Henning 1994).

Tiger

Vietnamese villagers may apply the name "Tiger" to any wild cat and have difficulty distinguishing Tigers from Leopards *Panthera pardus* (e.g. Eames and Nguyen Cu 1994, Pham Trong Anh and Nguyen Xuan Dang n/d). These problems also prevail in Lao (own observations) and Cambodia (Lic Vuthy verbally 1997), and presumably arise partly because rarely is a big cat seen well and most contacts are merely with signs. Misidentifications certainly occur: Do Tuoc (verbally 1998) was shown claimed Tiger footprints by villagers in Pu Mat which were probably those of Clouded Leopard *Pardofelis nebulosa* or Leopard.

Around Nam Xam National Biodiversity Conservation Area (Lao) some villagers reported two sorts of large striped cat, differing in tail length (T. Hansel verbally 1998). In northern Thailand, villagers also refer to a second form of striped cat, the *sua bong* (A. J. Lynam *in litt.* 1998).

Surveyors thinking that a villager is referring to Tiger need to ask precise, but not leading, questions to establish why the report does not refer to Leopard - or even Leopard Cat *Prionailurus bengalensis*. Few reports documented doing this; sometimes it clearly had not been done.

Wild cattle

Local information about wild cattle is a pitfall for the unwary. Duckworth (1996b) detailed villagers' confusion at one Lao site, revealed in conversation and then by

presenting multiple images of the species and asking the name for each image. S. Sawathvong (verbally 1998) considers, based on interviews over 10 years across much of Lao, that very careful interpretation is needed as three words (*Mouey*, *Kating* and *Ngoua*) are commonly used for wild cattle, yet only two species are widespread. Furthermore, when several forms of cattle are claimed, a white rump (the most obvious diagnostic character of Banteng) is rarely mentioned; people often claim to use the white pattern on the legs to distinguish between forms, although identifying biologically the species on this feature alone would be ill-advised (R. J. Timmins *in litt.* 1998).

Mouey is the standard name for Gaur. *Kating* appears to mean a bull, but is sometimes used for Gaur, particularly in the north. It comes from Thai and indicates external influence. *Ngoua* is Lao for any bovine species. Two compound words from it, sounding extremely similar to foreign ears, are used for two different species: *Ngoua Pa*, literally forest cow, is often used for Banteng, and *Ngoua Ba* for Kouprey. The meaning of *Ba* is unclear but it may come from, or actually be, the Lao word for crazy; R. J. Tizard (*in litt.* 1998) considers that it may also indicate a spirit cow (see sect. 4.6). Furthermore, the recent fame of Kouprey means that the name may be being used by villagers who have learnt it through the media, rather than in the field (R. J. Timmins *in litt.* 1998).

Deng (red) may be added to *Ngoua* or *Kating*; the presumption that this indicates Banteng has rarely been confirmed. An added confusion for people in decreasing direct contact with wild cattle is that the logo of the Thai drink named *Kating Deng* looks in shape much more like Gaur than Banteng.

It is possible that similar confusions surround names in the other languages of the region, but less information is available. In many places in India, local people classify Gaur into two 'species'; it seems that solitary old bulls are separated from the smaller herd-living bulls and females (K. U. Karanth *in litt.* 1998).

Confusion is exacerbated by regional variations and especially by outsiders assuming that each term refers uniquely to a biological species, and either tempting villagers to shoe-horn their ideas into such a structure, or, after the interview, attempting the shoe-horning themselves. This approach is flawed (see above) and is a major reason why villagers often appear confused; but few people from any culture can immediately embrace and perform well in concepts with which they are unfamiliar, particularly when the interviewer fails to understand the conceptual gulf. Moreover, the rarity of cattle sightings and (usually) poor viewing conditions nowadays mean that genuine confusion often exists in the observer's mind over which cattle species occur in an area (see Le Xuan Canh *et al.* 1997b). Such uncertainty often stems from incomplete knowledge about the variation in appearance of each biological species, with age, sex and other factors such as wallowing; when interviewing several villagers at one time, during the conversation they often argue between themselves about what features the cattle have (e.g. a white rump or not?), how many forms are present, and their relative abundance.

Currently, villagers' reports of wild cattle can only be assigned to species by detailed discussion of recent first-hand sightings to establish what the animal actually looked like. Evidence that this had been done was rarely presented in reports. Thus,

although presence of wild cattle can be reliably established from villagers, species identification is best done with material evidence or observation of tracks by experienced people.

Asian Elephant

The only identification problem for Asian Elephant is whether the information refers to tamed or wild animals. Few reports indicated whether there were, or whether it had been established whether there were, any tamed elephants in areas where wild ones were being claimed.

Claimed absence of a species

Concluding that a species is absent from a survey area using local information is difficult. Several cases were found where one author cited local opinion that a species did not occur, yet a later team was told, or even confirmed, that the species persisted. This paradox may arise because villagers do not think within survey area boundaries. A provincial governor can answer for the province as a whole (although his understanding of precisely where the information relates to will usually be vague, as it is secondhand; Heng Kimchhay *et al.* 1998), but a villager's answer usually reflects his traditional use area, not an abstract survey area. For a large remote survey area (e.g. many Lao National Biodiversity Conservation Areas), it may not be possible to find people able to answer for each part of the area.

Happenings described as 'recent'

In several cases, teams several years apart both received reports that a certain event had happened "recently, for the first time in many years". This may reflect patchy knowledge of later informants, but since it also involved high-profile events (e.g. crop-raiding by Asian Elephants), it underlines the need always to determine what is implied by 'recent'.

Origin of animals in trade and collections

The provenance of animals at zoos or in trade is difficult to assess as they often pass through several hands. In Vietnam it is rare to be able to trace the individual hunter concerned (Dang Gia Tung verbally 1997) and this holds for the whole region. This problem was reviewed, for market animals in Lao, by Duckworth (1997).

3.2.5 Weak documentation of findings

Findings presented carelessly can be put to only limited use. Several major weaknesses were found. In Vietnam, where (in contrast to Lao and Cambodia) many reports are written without external input, report standards are well behind the field abilities of most surveyors. This deficiency doubtless results from the rarity of international surveyors writing survey reports collaboratively with local counterparts (sect. 4.5.2). Presentations to local research institutes, to discuss the aims, contents and uses of reports, and the need for care in their preparation, seem to have been rare or ineffective. Not surprisingly, written quality suffers.

Lack of detail concerning records

Many Vietnamese authors lumped all information concerning a species without differentiating when it was collected, how it was detected, and whether it came from the site or its environs. In one extreme case Saola *Pseudoryx nghetinhensis* was listed for Yok Don National Park, a site well outside its currently understood geographical and ecological range. This was based upon a local informant who provisionally identified a set of Saola horns in the province capital (dozens of kilometers from the survey area) some years previously (Le Xuan Canh verbally 1997). This 'record' was not differentiated from the species observed in the field during the survey, and was even highlighted in the report's summary as a major finding of the survey.

If a document does not indicate clearly when weakly suggestive local information is under discussion, the reader may lack confidence in every identification in the report.

Some of the tendency to blur over results comes from deliberate inflation of findings (motivated, e.g., by a probably correct perception that people presenting a wealth of findings are more likely to secure future grants), but some could be countered by clearer explanation of the purposes of reports. Even where findings are dated and sourced, fuller documentation is often needed for full credibility. Two examples follow:

- Many reports list village information for Tiger but not Leopard, but do not indicate how the species was identified. The Leopard's regional status is unclear but it is probably not as scarce relative to Tiger as the aggregated village reports suggest. This suggests that a substantial amount of information concerning big cats as a group is being presented as specific to Tiger. Relating villagers' information on cats to species is extremely difficult (sect. 3.2.4); in many reports it was unclear whether the investigators knew this.
- Focal species presence was often 'confirmed' through footprints, without indicating the number examined, measurements taken, or (for cattle and elephants) how domestic / tamed animals were excluded. Notable exceptions include: Cox *et al.* (1992a) gave precise characters of some possible Kouprey footprints, allowing readers to make up their own minds; Timmins and Evans (1996) stated the size above which big cat prints were identified as Tigers'; Bergmans (1995) gave a critical measurement of a Tiger footprint; and Evans *et al.* (1996a) gave measurements for cattle footprints for every survey sector. The last was particularly useful, as subsequent discussion allowed the modification of some identifications.

The frequency of grossly erroneous species identifications (sect. 3.2.3) means that information in reports should be taken as reliable only where there is clear evidence of competence.

Lack of context for the records

Readers may draw misleading conclusions if reports lack sufficient context. Rabinowitz (in press) concluded that Tigers were proven by a 1994 publication to

inhabit Xe Pian National Biodiversity Conservation Area (Lao), but that WCS (1995d) had "confirmed absence". This strongly-worded term might dispose readers to conclude that Tigers disappeared during the mid 1990s. WCS (1995d) indeed recorded no Tigers from Xe Pian NBCA, but work in the NBCA comprised a week searching specifically, usually from boats, for large waterbirds. Chances of detecting Tiger signs were minimal and furthermore, the 1995 work was well away from the previous Tiger records. There is thus no evidence that Tigers even declined, let alone could be confirmed absent.

When survey reports detail what was done and where (e.g. Le Xuan Canh *et al.* 1997b tabulated effort at each survey area in each survey technique), readers can then assess whether, given the survey effort, a non-found species is probably absent, or whether the lack of evidence means little.

Comparisons with previous information from the area and from elsewhere were often absent or superficial in rushed outputs by external consultants and in most reports by Vietnamese agencies, and citations were often omitted or incorrect, thus hampering readers from tracing the other studies.

Difficulties with locating survey area

Locating survey areas was often difficult as no geographical co-ordinates were given, even on figures. Particularly in Vietnam, the numerous province, district and commune names which might be used to name a site, aside from names for protected areas and of natural features, meant that records from one place could appear under several names.

Vietnam's dynamic administrative structure regularly restructures provinces, districts and communes (e.g. in 1991 Nghe Tinh Province became Nghe An and Ha Tinh Provinces, and much land now in Ea So Commune of Ea Kar District, Dak Lak Province was until recently in M'Darak District). Tying survey results to administrative names can therefore cause difficulties in later years.

Some protected area names are not unique. The Nam Kong provincial protected area in north Lao can be confused with one in the south called here Nam Ghong (following R. J. Tizard verbally 1998) but elsewhere sometimes referred to as Nam Kong or Nam Khong (e.g. Salter *et al.* 1991, Berkmüller *et al.* 1995a). Le Vu Khoi (1995) called two Vietnamese protected areas Bu Huong. In fact, that in Quang Binh Province is seemingly a typographical error for Phong Nha Nature Reserve (Tran Minh Hien verbally 1998), while that in Thanh Hoa Province is a frequent misnomer for Pu Hoat Nature Reserve. The real Bu Huong, which anyway is now often spelt Pu Huong, is in Nghe An Province.

It is unlikely that all such nomenclatural minefields were negotiated here and readers should remain vigilant for further confusion.

Poor editing and proof reading

Many reports from Vietnam seemed neither to have been edited nor proof-read. Internal inconsistencies and obvious errors were too frequent in many for a reader to feel confident about any individual piece of information, especially in tables (where a misplaced or erroneous symbol can completely change a species's status). For

example, a recent report from Phong Nha Nature Reserve (Le Xuan Canh *et al.* 1997a) purported to present comprehensive information about selected threatened species in three sections, yet the information is often inconsistent, including for both Asian Elephant and Tiger; Asiatic Jackal *Canis aureus* is listed as recorded in three different ways: from footprints (text), by direct observation (Appendix 2) and collected as a specimen (Table 2). The only reasonable treatment of such self-contradictory information is to disregard all of it. An external reviewer drew the senior author's attention to these and other problems at draft stage, yet they were not corrected.

There is a basic lack of understanding (exemplified by various authors shamelessly saying "oh that's a mistake!" when asked about specific points) that a report riddled with errors may be worse than no information at all.

3.2.6 *Plagiarism of findings*

Some reports from one Vietnamese institution lifted text directly between reports and from those published outside the institution. Original authors probably chose their words carefully, but the plagiarists did not. The phrase "hunters claimed to regularly shoot wild buffalo, but it was not easy to ascertain whether they were truly wild, feral or hybrids" sounds feasible for unprotected remote eastern Cambodia (Desai and Lic Vuthy 1996); but upon finding it in a subsequent report on Yok Don National Park, the reader's credulity is stretched past breaking point that hunters really would make such self-incriminating claims, even if free-ranging buffalo were sufficiently numerous to be shot "regularly". The sentence of Laurie *et al.* (1989) that "Banteng sign was abundant" has done sterling service in later reports covering the same area, but when it is copied, it may no longer be accurate. Other examples of such plagiarism could have been cited here. Furthermore, the difficulty of getting the offending reports may mean it is actually quite common.

Uncritical copying (and falsification, below) is problematical because, particularly for the focal species, results from even a few years previously, may not reflect the current situation. Misplaced priorities may then pervert the course of subsequent conservation action.

3.2.7 *Falsification of findings*

In some Vietnamese reports data were manipulated or invented. Detecting this was difficult because such authors masked their activities. Trying to obtain reports directly from one such person resulted in a lengthy chain of excuses (including the unanswerable claim that since the institute's staff funded their fieldwork personally, they had no obligation to circulate reports!). To give an example of deception, dates of sightings were changed in a table lifted directly from an earlier report, so that it seemed the information was gathered in the year covered by the survey grant. When asked about this, the perpetrator was unruffled; it did not matter as the report was 'not official'. Several different individuals from various institutions probably use these tactics.

Another motivation to falsify data, apparently common, is a feeling among some Vietnamese scientists that if a survey is subsequently shown to have overlooked a

high profile species, the earlier surveyors look inept. Damage limitation therefore involves claiming most likely species of large mammal, and often some less likely ones. If the species is subsequently found, one cannot be charged with overlooking it; if it is not, then the obvious explanation is that it became locally extinct. However, numerous near-complete species lists disincline the reader to credit any information in any of them. Considerably more credibility is gained by authors who present their findings accurately, then discuss explicitly which other species might be present. However, as overseas project assessment and grant-awarding panels do not always include somebody with detailed knowledge of the region's fauna, implausibly long lists of high-profile species may indeed be credited.

During one inter-agency liaison to produce a national status review of a focal species for an international workshop, one person urged for substantial inflation of the perceived national population to attract international species-related funding to the country. This man represented the most powerful agency, and so his views carried the day; the review is acknowledged, sorrowfully, by the lead author to be deliberately misleading. It is unclear how widespread this practice is (the foregoing was revealed only on condition of anonymity) but it indicates the need for caution in interpreting such reviews.

3.2.8 Poor dissemination of information

Most libraries contained few relevant references and locating material was frequently time-consuming (because it was uncatalogued); often the best strategy was a comprehensive cold search. Not all bodies active in the region distribute reports widely to other relevant agencies, and some could not even locate all their own reports. Without full information, every party's ability to make decisions for conservation is compromised and outside compilers of secondary sources use incomplete information. Particularly if information is for popular use, few people load their output with cautions about incompleteness and unreliability. Thus, various books and even Internet sites purporting authoritative overviews of Tiger status in the region are misleading, at least partly because they had not access to some important findings.

Certain Vietnamese scientists were not disposed to release information, even reports. Sometimes their reports were plagiaristic or fabricated, but the sentiment that the information was a personal property partly shaped this attitude. The understanding seemed weak that information is for public use once written up by staff of a body whose role is to document and circulate information on wildlife (e.g. NGOs and government research bodies).

3.2.9 Lack of information concerning protected areas and other localities

Berkmüller *et al.* (1995a) presented protected area fact sheets with vital statistics (including geographical co-ordinates, administrative districts etc.) for all declared and proposed protected areas at the national level in Lao, but such comprehensive troves of information have not been produced for the other countries.

Cambodian protected areas were mapped in DNCP / IUCN (1996) but the co-ordinate grid is somewhat displaced. Co-ordinates derived from this map therefore

need modification.

No comprehensive source was traced for Vietnamese protected areas; a variety of A4 sheets giving co-ordinates and administrative regions, and unpublished maps gave guidance but had many contradictions. The original information concerning protected areas is usually held in the province, and Hanoi institutions may not have even basic information. Some locational information given here for Vietnamese protected areas is doubtless incorrect; comparison of species's distributions with that of Tiger Conservation Units (sect. 3.1.7) was also hampered, particularly as so many Vietnamese TCUs are themselves small.

The TCU map itself (Dinerstein *et al.* 1997: fig. 5) has anomalies respecting protected areas. The selection of Lao National Biodiversity Conservation Areas is esoteric, while some boundaries are incorrect (for example Yok Don National Park).

3.3 Threats to the species in Indochina

High commercial value places all focal species at elevated risk. Hunters seek them far into remote areas and use extreme methods. Between 1995 and 1998, a fifth of the many Tigers poached in Virachey National Park were killed with mines associated with Sambar *Cervus unicolor* bait (Wikramanayake 1998). Remains are sold to middle-men and the eventual destination for many is China.

Other threats include habitat fragmentation (sect. 5.2), human-animal conflict (sects 6.3) and, for Tiger, gross reduction of the prey base (sect. 6.2.1). Only the last is likely to be important in determining the pace of decline.

Resolution of human-animal conflict can be urgent locally, for example the Dong Nai elephants in Vietnam (sect. 6.3.5), but replication of local solutions will not reverse region-wide population declines as such conflict is not the main driving force. Issues of large-scale habitat conservation and resolution of conflict are primarily mid-term priorities so that, should trade-driven hunting pressure be reduced, suitable areas remain to support viable numbers.

The status of Asian Elephant in Lao is perhaps the most positive part of this review, but, despite the relatively healthy numbers (sect. 3.1.2), poaching may increase through the combination of several factors: more and freer trade with, and decreasing elephant populations in, neighbouring countries; increasing affluence in Lao and in potential consumer countries; and a less restrictive national government. Furthermore, the current Lao elephant sex ratio is essentially unknown and if it has been strongly skewed by selective mortality of males, the viability of numbers nationally may be considerably lower than raw numbers would suggest (sect. 3.1.2).

There are no robust data from Indochina to assess the relative importance of threats. However, Tiger, Asian Elephant and Gaur in India, and Banteng in Java, all survive in highly fragmented habitat, in relatively close proximity to stock and crops, in countries with high human population densities. This suggests that commercial trade is a major threat to populations of these species. If it continues, the regional status of Tiger, Asian Elephant and wild cattle populations will soon resemble today's global status of the region's two rhinoceros species: largely extinct with only a few

isolated populations remaining, and these in decline.

3.4 Current conservation initiatives for the species in Indochina

3.4.1 Information gathering

Ten years ago Indochina was, biologically, one of the least known regions in the world. Effective conservation planning was very difficult as the priorities were unclear. In the interim, status surveys for the focal species, mainly within broader work, have taken place in all four countries.

Lao

Field surveys will soon have covered all established and most proposed national-level protected areas. This is supplemented by a questionnaire survey of local administrative bodies for information about Asian Elephant, wild cattle, rhinoceroses and Asian Tapir, but not Tiger. The earlier results are just starting to come in (K. Khounboline verbally 1998).

Vietnam

Surveys in Vietnam have generally been *ad hoc* and while some important areas have been covered, no recent information is in the public domain for several others, notably, for the focal species, Bu Gia Map Nature Reserve (Binh Phuoc Province), Chu Mom Ray Nature Reserve (Kon Tum Province), Ta Dung Nature Reserve (Dak Lak Province), Cat Tien National Park-Cat Loc Nature Reserve (Dong Nai and surrounding provinces) and Krong Trai Nature Reserve and Song Chinh District (Phu Yen Province). Do Tuoc and Le Trong Trai (in prep.) are synthesising information from provincial sources to assess the national status of various threatened species (including all the focal species).

Cambodia

Cambodia is the least surveyed country due to dangers of working on the land; consequently, it hosted the region's only aerial large mammal survey (Olivier and Woodford 1994). Notable ground surveys include Sun Hean (1995a), Desai and Lic Vuthy (1996) and Timmins (in prep.). Two major surveys gleaned information from local people are in progress: freelance work by F. H. Weiler seeking, ultimately, Kouprey, with consideration of other very large mammals, and an IUCN/SSC Cat Specialist Group survey of Tigers and over 20 other species.

An interim report of the second (Heng Kimchhay *et al.* 1998) gives the most accurate recent overview of large mammals in Cambodia; notably, the reliability of local information is discussed explicitly. The country is divided into Biodiversity Management Regions, each containing numerous Individual Hunter Areas. As locations of Individual Hunter Areas are not yet available and analysis so far is provisional, information is included in Annexes 1-4 of the present report only for specific named sites. Considerable use of the information is, however, made in the text (sect. 3.1) as it seems unlikely that the overall conclusions will be revised

greatly. The final report on this project will be an excellent baseline for directing future survey work and conservation efforts.

Yunnan Province, China

Elephant surveys in Yunnan (Santiapillai *et al.* 1994) gave a clear picture of the species, but little recent work tackled Tigers or wild cattle.

Trade

Trade levels may determine the fate of these species (sect. 3.3). Short surveys in and along the borders of all countries (Martin 1992a, 1992b, Srikosamatara *et al.* 1992, Baird 1993, Srikosamatara and Suteethorn 1994, Li Wenjun *et al.* 1996, Martin and Phipps 1996, La-Ong *et al.* 1997, Compton in prep. a, in prep. b) are not yet supplemented by a regional overview, although Nash (1997b) summarised some of the available information for Lao and Cambodia.

Conflict

Information on human-animal conflict has been collated in an *ad hoc* fashion; small amounts are in many survey reports, with a substantial amount for Lao in Berk Müller *et al.* (1995a). More detailed studies at specific sites are documented by Santiapillai (1991a, 1991b), Walston *et al.* (1996), Dawson and Do Tuoc (1997) and Pham Mong Giao *et al.* (1997). Notes on Tigers are given in Heng Kimchhay *et al.* (1998). No overview yet covers problem areas for any country or the region.

3.4.2 Putting the information to use

An overview of Tiger conservation activities worldwide is presented in Toyne and Hoyle (1998).

Guiding protected area policy and establishment

In Lao, Yunnan Province and Vietnam, considerable bilateral aid is being given to the establishment and management of protected areas. In Cambodia the security situation limits the ability to make concrete progress. In all countries, some key areas for the focal species are supported externally.

FAO has proposed a project to establish Managed Elephant Ranges in South-East Asia, including Lao, Vietnam and Cambodia. If this ambitious project is implemented, ample funds and time-scale will be needed.

Trade issues

Little specific work in Indochina is tackling the issue of focal species trade. Vietnam and Cambodia have recently joined CITES. China has been a member for a long time and Lao has expressed an intention of becoming so.

Legal protection

All focal species are fully protected in all countries. In Lao, hunting is banned in all seasons, except with special approval of the council of ministers, or in defence of human life or property. Animals in the latter class become the property of the state

(Salter 1993a). Lao wildlife law is currently under review; current protection levels for the focal species will not be weakened (W. G. Robichaud *in litt.* 1998). In Cambodia, laws under review intend to strengthen protection of the focal species (Sun Hean, C. Poole *in litt.* 1998). Killing Tigers or Asian Elephants may result in the death penalty in China, although this appears only to have been used with the latter (Wang Yingxiang verbally 1998).

Public awareness

Education campaigns about the species and threats to them, in progress for some time, received a boost in 1998 as it is the Year of the Tiger.

In Vietnam, WWF is publicising the national plight of Tigers and their habitat with triple foci: in Hanoi (the national capital), Chu Mom Ray Nature Reserve and surroundings (Kon Tum Province; possibly the most important Tiger site nationally) and A Luoi District (Thua Thien-Hue Province; a schools education campaign focusing on Tiger). The latter appears successful in stimulating thought about Tigers and conservation among the ethnic minorities. This programme follows earlier work (in Hanoi, Da Nang and Ho Chi Minh City) to raise awareness in customs and checkpoint officials that wildlife, notably Tigers, need attention in trade control / CITES enforcement.

The WCS Lao Program coordinator for training and education ensures that the focal species are given prominence (e.g. all feature on the 1998 calendar). A major focus of the Government-initiated 1998 National Wildlife Conservation Day was the country's Asian Elephants.

Relatively little awareness work appears to be being undertaken in Cambodia and Yunnan Province.

PART 4: RECOMMENDATIONS FOR FUTURE SURVEY WORK

The key points for a conservation strategy for Tigers in Indochina will shortly be published (Rabinowitz in press). All of Rabinowitz's problem analysis ("the current realities of Tiger conservation in Indochina") and action points ("recommended immediate actions to conserve the Tiger in Indochina") were supported by the present review. Parts 4-6 expand to consider the needs of all focal species and to discuss certain topics in greater depth to illuminate the background to the recommendations and to make the urgency for their implementation plain.

4.1 Sites and areas needing survey

Gaur is widespread in the region. Asian Elephants are secure in the short term in Lao, Yunnan Province and probably Cambodia; their status in Vietnam is desperate. Tiger still occurs widely but its steep decline means that only relics of even recent distribution survive. Banteng seems confined to small parts of Indochina, persisting outside Cambodia only as isolated populations (sect. 3.1.4).

Tiger and Banteng are therefore the most urgent regional survey priorities. Nationally, Asian Elephant surveys are a priority in Cambodia (to confirm the areas interviews suggest are important) and Lao (which has the most conservable population). Poaching may have imbalanced population sex ratios and thus affected population dynamics (sect. 3.1.2), so future survey of Asian Elephants should characterise the age/sex structure; at least, the proportion of adult bulls should be assessed as these are most likely to be poached for ivory or killed during conflict. Mature bulls can be identified from footprints as print size reflects animal size, and mature bulls are larger than immatures and (by 10-15%) than females (see Sukumar 1989, Barnes and Kapela 1991, Dudley *et al.* 1992, Lindeque and van Jaarsveld 1993, Hile *et al.* 1997); as with the survey recommendations in sect. 4.2, field validation of the technique before widespread use is required, noting particularly that growth rates of captives differ from those of wild animals (Lindeque and van Jaarsveld 1993).

Distribution of healthy Gaur numbers correlates well with those of Asian Elephants, Tigers and / or Banteng, so Gaur survey needs can be largely met by considering them during work for the other species.

Since similar techniques are used to survey all focal species, information should always be collected upon all of them. Where one species is highlighted below, it is merely that which should guide scheduling and site selection.

Some sites below have been visited recently but inappropriate methodology or personnel was used or clear results are not available.

Recommendations were formulated by examination of available data, by discussion with key people, from the senior compiler's own perceived priorities and from detailed consideration by S. Sawathvong and R. J. Timmins (Lao).

Assessment of the urgency for each survey is subjective, but in general, a site with an acute priority for survey indicates that:

- No detailed survey results for the last six years or more were traced.
- A sufficient area for long-term conservation of the species is believed to remain.
- There are reasonable grounds to believe that some animals remain.

However, other factors may be used (e.g. perceived threat level to a site), meaning that it was not possible to set rigorous guidelines for categorisation. Sites are mapped on Figs 1-4. Some areas lie across international borders from other areas already known to be important and are considered additionally in sect. 5.8.

4.1.1 Surveys centred upon Lao

Acute Priority

- Jiangchung County, Yunnan Province and adjacent north Phongsali Province, Lao, to assess Asian Elephant herds which reportedly occur mainly in Lao. The survey should be based in Lao but comprehensive survey of the Yunnan area should include questioning local people, assessing habitat suitability and, if elephants have been into Yunnan recently, sign surveys.
- Nam Kan proposed National Biodiversity Conservation Area. Provisional reports suggest high importance for focal species. There are strongly held hunting taboos on at least gibbons in the area (J.-F. Reumaux verbally 1998).

High Priority

- The former Pa Sak Xaignabouli proposed protected area, adjacent and east of Nam Phoun NBCA (Xaignabouli Province). Large numbers of focal species in the latter, particularly elephants, suggest that Pa Sak Xaignabouli may be important.
- The unprotected area west of Sangthong (Dong Phaken) and Phou Phanang NBCA (Vientiane Province and Prefecture). The Sangthong area retains important elephant numbers and local reports indicate that Dong Phaken and Phou Phanang are also important.
- Xe Sap NBCA. Although visited twice, briefly, access problems have so far prevented survey.
- The Nam Xan basin, including Sayphou Hgou, in Bolikhan District (Bolikhamxai Province); from 20 km north of the district town to the province border. The area was a royal hunting area 40-50 years ago. It abuts the southern Xiangkhouang site (Site 102, Annex 3) and Viengthong District (below).
- Viengthong District (Bolikhamxai Province), including Nam Chouan proposed NBCA; the latter has been a high survey priority since 1993, but security concerns prevented access. Work elsewhere in the district indicates important large mammal populations (W. G. Robichaud verbally 1998).

Medium Priority

- Dakchung Plateau (Xekong Province), where elephant signs were found in 1997 and from where there are recent Tiger records.
- Phou Ilang and Phou Damlek, west of the Mekong in Champasak Province; although Cox *et al.* (1992a) concluded that people were too widespread and active in the area for Kouprey to persist, S. Sawathvong (verbally 1998) believes writing off the area for very large mammals may be premature.
- Champasak Province east of the Mekong south from Xe Pian NBCA to the Cambodian border.
- The mountainous area between Hin Namno and Phou Xang He NBCAs, Khammouan Province.
- Mountains to the north of Xe Bang-Nouan NBCA, Savannakhet Province.
- Two proposed NBCAs (Berkmüller *et al.* 1995a) about which very little is known, namely Phou Theung and Phou Kathong.

4.1.2 Surveys centred upon Yunnan Province, China

Acute Priority

- Assessment of Banteng status in Zulin (Simao County).

High Priority

- Tiger survey of all four parcels of Xishuangbanna National Nature Reserve east of the Mekong.
- Elephant survey in Mengla (Xishuangbanna National Nature Reserve) and adjacent Phongsali Province, Lao. Some dozens of elephants are unaccounted for: they seem no longer resident in Yunnan (Jiang Wang Gao verbally 1998), yet Lao sources complain that elephant numbers have dropped due to the Chinese luring them over the border with salt. Potentially this population may have been poached; if so, attention may turn to populations of Xishuangbanna National Nature Reserve with less international ambiguity.

4.1.3 Surveys centred upon Vietnam

Acute Priority

- Examination of recent satellite imagery and aerial photographs of all areas listed to hold Banteng but lacking recent information: Ba Na Nui Chua Nature Reserve (Da Nang Municipality), Chu Prong District (Gia Lai Province), Krong Trai Nature Reserve and Song Hinh District (Phu Yen Province), Dak Mil District (Dak Lak Province), Bu Gia Map Nature Reserve (Ninh Thuan Province), Cat Tien National Park and Bien Lac-Nui Ong Nature Reserve (Binh Thuan Province). The six areas retaining the largest wildernesses (sect. 5.2) will be the

most promising to retain Banteng, and should be surveyed immediately.

- Tiger survey of Chu Mom Ray Nature Reserve (Kon Tum Province) and along the international border to the north and south.
- Tiger survey of Hien and Giang Districts (Quang Nam Province) and western Thua Thien-Hue Province.
- Assessment of recent reports of Tigers and large numbers of Asian Elephants in Kon Plong District, Kon Tum Province, and the adjacent area in Binh Dinh Province.

High Priority

- Assessment of Asian Elephant status in Ninh Phuoc District, Ninh Thuan Province.

Medium Priority

- Survey of Asian Elephants in Dak Lak Province including the annual location and management of tamed animals. The latter is a vital component as elephants are seasonally released into forest areas. To understand the current wild status, the following questions about free-ranging tamed animals need addressing:
 - where are animals released, when, and for how long?
 - are any released lacking hobbles, chains or other signs of ownership?
 - do they live alone, herd with others or join wild herds?
 - are they visited by their owners during periods of release?

Wild animals should be sought in Nam Ka, Nam Nung and Ta Dung Nature Reserves. Advice should be taken from elephant capturers as to the current distribution of wild animals.

- Survey of a few small level 3 Tiger Conservation Units lacking information on the focal species (sect. 3.1.7), intensively enough that if no evidence is found, lack of regular populations can be confidently inferred. Some will be covered above. If the first four level 3 TCUs all prove negative, then effort should be transferred to level 1 and level 2 TCUs.

4.1.4 Surveys centred upon Cambodia

Acute Priority

- Kravanh mountains, reputedly still full of Tigers and elephants.
- Keo Sema District (Mondulkiri Province).
- Provinces of Preah Vihear, Kompong Thom, Kompong Speu, Kratie and Pursat (although the security situation in the latter is unlikely to stabilise).
- Kulen Promtep Wildlife Sanctuary is potentially important for the focal species including Banteng and extending the area could link it with Dong Khanhthung proposed National Biodiversity Conservation Area (Lao).

High Priority

None

Medium Priority

- Virachey National Park, an area of high importance on its own account and as an integral component of a trans-boundary conservation area in Lao and Vietnam as well as Cambodia.

4.2 Survey methodology and implementation

As much work reviewed was of low calibre (sect. 3.2), considerable discussion is given for implementation and writing up future surveys for the focal species. These recommendations differ from those in Le Xuan Canh *et al.* (1997b) for Kouprey surveys, as the four focal species can be identified relatively confidently by tracks, making direct observation not the best use of time.

As the regional distribution of the focal species is still poorly known, extensive surveys covering large areas and aiming to assess relative abundance and population trends remain more important than intensive work aiming to estimate population density. Estimates of relative abundance and trend are invariably more important for directing conservation than are density estimates.

The basic survey method will continue to be looking for signs. Sightings of animals are rare in Indochina and interpreting local information is often difficult (sect. 3.2.4). Sign-based surveys should investigate all focal species and also attempt to assess the ungulate prey base for Tigers (see Karanth and Stith in press, Karanth in press b). Wemmer *et al.* (1996) give general recommendations for sign surveys; full note should be taken of their cautions. Tiger survey techniques are discussed in Rabinowitz (1993), Karanth (1987, 1993, 1995, in press a) and Franklin *et al.* (in press).

All surveys should be repeatable. Notably, results should be presented in sufficiently detail to allow comparison with the results of return visits.

Reliable survey needs substantial field time. This is against current trends seemingly seducing both funders and implementing agencies, that some forethought, and rather more computer resources, can pare down real field survey work to so-called rapid appraisals conducted by almost anybody.

Some reports give a palpable feeling that the team was under such pressure to produce 'results' that quality was sacrificed: instead of taking sufficient fieldwork time to draw useful conclusions about the site and its mammals, exercises such as computer-generated maps of wildlife habitat distribution are presented - even though some species are so poorly known that even basic habitat use is conjectural, and there is no information on critical microhabitat features.

Increased survey efficiency must be balanced by recognition that in today's Indochina very large mammals are secretive and live at low densities. Only a

dedicated sign-survey specialist with adequate time can assess their status well. Prolonged, and therefore expensive and logistically complex, surveys are doubtless unpalatable to many funders and implementing agencies, but this alone should not stimulate second-rate work. Poor quality fieldwork cannot be masked by glossiness of report or sophistication of analysis; Karanth (1993) elegantly dubbed fieldwork attempting this as "garbage in-garbage out models [with the philosophy] let us save the Tiger here and now on a laptop computer". Five years on, the notion that a 'rapid appraisal' substitutes for a field survey persists.

Constraints of funding and timing mean that rapid appraisals will continue. Three problems should be addressed by future endeavours:

- Inappropriate executants selected;
- lack of focus on what should be achieved in the limited time; and
- failure by other people, and apparently in some case the executants, to realise that rapid appraisals are prioritisation exercises to guide survey work, not a substitute for it.

In particular, interaction between the first two factors may mean that people competent in their own field are pressured to expand outside it and then produce sub-standard work in other fields.

4.2.1 Identification of species and individuals from their signs

Footprints

In South-East Asia several species with similar footprints are often sympatric, e.g. Gaur, Banteng, Asian Buffalo and potentially Kouprey; and Tiger and Leopard. Tamed elephants and domestic and feral cattle and buffalo also present problems. Clearly, surveyors experienced in interpreting the tracks of the focal species and close relatives should be employed.

Tigers and Leopards

Identification of big cat tracks in Indochina needs particular care. Some surveyors in the region claim that Tiger and Leopard footprints can be distinguished simply on size and social structure, *viz.* they assume a Tiger small enough to be confusable with a Leopard is always accompanied by its mother. This does not take account of the following:

- Tiger populations in Indochina are highly disrupted; assumptions about social behaviour derived from healthy populations are not appropriate.
- Analysis of dozens of Indian tracks suggested that some Leopards have rather bigger feet, and that some Tigers rather smaller feet, than had previously been assumed (Sagar and Singh 1990).
- Considering stride length in association with print size may give a better ability to identify the species, but there is still not 100 percent separation (Sagar and Singh 1990: fig. 2).

- Tracks are often found in isolation where only a small area of substrate is suitable for retaining them. Individuals within family parties of big cats may be separated by substantial distances and not all, therefore, may cross the suitable substrate. Thus, the track record may not accurately reflect the passing group.

Sagar and Singh (1990) urge caution for identification to species even in India: "there is a need to study in greater details the tracks and signs of large cats" and "interpretation will be more difficult if the data have not been collected by one who has received adequate exercise on the subject". Moreover, in Indochina, no documented calibration of footprint sizes exists for each cat species. Information from other areas should not be used, as variation in Tiger size across its geographical range (e.g. Herrington 1987, Kitchener in press) and suggestions of complex patterns of size variation in Leopard (S. Miththapala pers. comm. to Kitchener in press) indicate that any size threshold values to distinguish Leopard prints from Tigers' would vary across the range.

A recently published sheet of mammal footprints for field use in the region (Green World Foundation 1997) is an admirable initiative but, however, underestimates print size for some species. Tiger footprints are given as 93 mm from back of main pad to tip of longest toe, claw excluded, and Leopard as 82 mm; realistic figures would indicate that Leopard feet may exceed 93 mm (although probably only exceptionally in Indochina; A. R. Rabinowitz *in litt.* 1998), while adult Tigers' paws frequently exceed 100 mm, even 120 mm, in length, that both species vary widely in size, and that overlap between them is wide. In the absence of region-specific measurements, a main overlap zone cannot yet be defined; but variation in substrate and the effects of weathering will combine to make it large, and an ongoing identification pitfall for the inexperienced.

It is therefore currently unacceptable to confirm the presence of Leopards on track characters except under special circumstances (which should be stated), e.g. many track sets are found with no footprints big enough for adult Tigers. Clearly, before big cat footprints other than fully-grown Tigers can be assigned to species in Indochina on the basis of size or other measured characters, an extensive series of measurements should be taken from as many known individuals (Leopards, Tigers and Clouded Leopards) as possible, e.g. in zoos (if animals are of known geographical origin, and moving naturally) and from camera-trapping surveys in Indochina.

Such a series would also allow the utility and power of multivariate analyses of footprint measurements to distinguish Leopards from Tigers and to identify individual animals to be assessed. These techniques are capable of distinguishing Fisher *Martes pennanti* tracks from those of American Martens *M. americana* (Zielinski and Truex 1995) for example, and can identify individual Pumas *Puma concolor* (Smallwood and Fitzhugh 1993). They hold much promise for surveys in Indochina and are likely to be far more useful than a simple threshold figure for distinguishing tracks of Leopards from those of Tigers.

Wild cattle

Wild cattle tracks are readily identifiable to species by those sufficiently

experienced (e.g. Lekagul 1952, Wharton 1957). This description covers few international biologists now active in Indochina. Gaur and Banteng prints can be distinguished where impressions are clear and a number of prints, preferably of several animals, are examined; but nobody can identify with 100% confidence all wild cattle tracks found. With experience, the proportion identified grows, but old prints, single impressions, those on poor substrate, and the tracks of young animals may never be identifiable.

Tabulated sign survey results with no line for 'cattle sp.' instantly alert the reader: were all cattle tracks assigned to species?; or were the unidentified ones omitted? The former is not reliably possible, while the latter is unhelpful as such tracks indicate cattle population health in an area, especially where they constitute the majority of signs found; if not included, the importance of the area to wild cattle will be under-assessed.

As with big cats, gathering and publication of a series of measurements of prints in Indochina left by known species is urgent. This should include domestic cattle, which show wide morphological variation across the region.

Husbandry of cattle and buffalo varies across the region. In some areas, substantial numbers roam unattended and far from villages for many weeks; in others, cattle are guarded so assiduously that they lack inclination to wander far or alone on the rare occasions it would be possible. Sign-based cattle surveyors should establish from local herdsmen the numbers, distribution and husbandry system of the area's domestic bovines, to allow interpretation of cattle prints found.

Asian Elephant

In Nam Phoun National Biodiversity Conservation Area, Boonratana (1998b) found signs of tamed elephants widespread as they are released into the forest for several months per year. Distinguishing domestic from wild animals was possible as drag marks of chains tied to their feet were visible. Locals reported that some or all released animals in Yok Don National Park also carry chains and bells; furthermore, males with tusks are less often released now because of the risks from poachers (E. Kemf *in litt.* 1998). It is unclear if all free-ranging tamed animals in the region carry such distinguishing marks, and furthermore footprints are more durable than are chain marks. In areas where tamed animals are habitually taken (e.g. Yok Don National Park) tracks may refer not just to released tamed animals but to those accompanied by people.

Faeces

Wild cattle cannot be identified reliably from the shape and size of their faeces; other conventional (i.e. non-molecular) techniques such as faecal pH also proved unhelpful in identifying dung to species (see e.g. Hansen 1978, Rollins *et al.* 1984). Big cat faeces are also difficult to assign to species with confidence. Elephant dung presents relatively few problems, although inexperienced surveyors may confuse it with that of rhinos.

However, the powerful techniques of molecular biology may soon provide surveyors with the means of identifying both species and individual animals from the

DNA within their faeces (see Kohn and Wayne 1997 for a review; also see Reed *et al.* 1997 for important cautions about potential limits to these techniques). Identifications of cats and cattle to species may become possible even through samples collected by field personnel lacking previous experience of the species.

4.2.2 Presence-absence surveys

Confirming species's presence in an area by signs is only possible if those signs can unambiguously be identified. Faeces are thus of no use for wild cattle (until validated molecular techniques become available) and of limited value with Tiger. Elephant dung can be used, with care needed if tamed elephants occur in the area. Experienced surveyors need to be employed.

Confirming the presence of the focal species using footprints presents fewer problems but identification pitfalls remain (sect. 4.2.1).

Demonstrating a species's absence allows subsequent effort to be concentrated where the species may yet survive. General-purpose surveys (including most work reviewed here) may confirm a species's presence but are unable to confirm its absence; even sign-based surveys aiming to determine relative abundance and population trend (sect. 4.2.3) will rarely convincingly demonstrate absence. However, all focal species visit water regularly and consequently, if experienced sign-based surveyors spend enough time checking all the likely sites for the species in the area, a lack of signs can be taken to indicate a population already extinct or insignificantly small.

Presence-absence surveys should quantify time taken and area covered, and the frequency with which signs were found compared with how much suitable substrate was checked. This is long-winded in expression (it is not reducible to a simple quantity), subjective, and its validity depends on the surveyor's experience; but it is preferable to bald sign encounter rates.

Where Tiger densities are very low, field surveys can record reliably only their presence or absence (Karanth *in press a*); where numbers are higher, more detailed work can be attempted (sects. 4.2.3-4.2.5).

Encounter rates of carnivore tracks can be boosted by scent stations: the ground is conditioned to take track impressions well, and a scent attractive to carnivores is laid. This is often a fatty acid tablet but others used include real and synthetic Bobcat *Lynx rufus* urine. Stations take time to establish, results are weather-dependent and a large sample is needed because of low visitation rates by felids (O.-G. Støen *in litt.* 1998). The WCS Lao Program experimented with the technique in 1998; an analysis will be published shortly.

4.2.3 Indices of relative abundance and estimates of population density

Track-based methods

Using track-counts to estimate the relative abundance of large mammals raises numerous problems. The following list is not exhaustive.

- Identification-related problems (sect. 4.2.1).
- Substrate-related problems. There must be adequate quantities of substrate

capable of retaining footprints throughout the survey area. Comparing areas with dissimilar substrata introduces large errors.

- Selecting representative, comparable areas. In California the number of carnivore tracks was influenced strongly by topography, vegetation type, stream proximity etc. (Smallwood and Fitzhugh 1995), while Karanth (in press a) found that where Tigers used roads as travel routes, road density (length of road per unit area) strongly influenced sign encounter rates. Such findings urge strong caution in using sign-based methods to compare areas, although effects of these covariates, including weather, on track density estimates can be controlled for by analysing data with a covariance model (e.g. O'Donoghue *et al.* 1997).
- Deciding how many animals left the tracks found. This is more problematical for group-living species than for solitary ones. The problem can be (partially?) overcome by counting the number of transect segments containing tracks (e.g. Laurie *et al.* 1989) rather than counting the actual number of tracks found (e.g. by Le Xuan Canh *et al.* 1997b); the latter method is flawed by the impossibility of setting objective rules for determining what constitutes an individual 'sign'. Furthermore, per-segment presence-absence data are less biased by observer-skill related variation and by high counts caused by, e.g., the presence of a Tiger kill (i.e. where many tracks do not reflect many animals but simply frequent use of an area).
- Differential detection of 'cohorts' (e.g. age / sex / dominance classes); e.g. juvenile Pumas seem to avoid roads (Barnhurst and Lindzey 1989, Smallwood and Fitzhugh 1995).
- High sampling effort is needed for animals at low densities and to overcome patchiness in track density; these problems are particularly pertinent to Indochina. Consider the following scenario: during a population decline, Tigers in low-quality habitat might move to fill vacancies in nearby higher quality habitat, and consequently track density might decrease only in the low-quality habitat. Survey work restricted to high-quality habitat would not detect the decline (Beier and Cunningham 1996).
- Weather-related problems (but see above).

In theory track-counts can also be used to estimate population density. If individual animals can be identified from their footprints (see sect. 4.2.5), density can be estimated using techniques of mark-resight analysis (e.g. Minta and Mangel 1989). If they cannot, track-count based estimates of density assume that the number of footprints found reflects population density well. Such a relationship is none too likely with the numerous problems above (but see below).

Despite these many problems, track counts do hold promise, particularly as indices of relative abundance and population trend (e.g. Mooty *et al.* 1984, van Dyke *et al.* 1986, Koster and Hart 1988, Thompson *et al.* 1989, Kendall *et al.* 1992, Mandujano and Gallina 1995, Smallwood and Fitzhugh 1995, Beier and Cunningham 1996, Forbes and Theberge 1996, O'Donoghue *et al.* 1997). And Karanth (1987: 130) suggests that "reliable indices of relative densities of Tigers in different parts of a habitat or over different periods can be systematically developed from Tiger signs

like tracks". A few studies have even used track-counts to estimate population size accurately, e.g. van Sickle and Lindzey (1991) used a track-based method to estimate 14.2 ± 6.3 (SE) Pumas for an area known to contain fourteen.

The many potential problems with track-counts make it essential that they be validated in Indochina before adoption as standard survey techniques. Furthermore, whenever possible two different methods, not relying on the same assumptions, should be used to assess the size or relative abundance of large mammal populations. Before any survey is conducted, surveyors should consult with people familiar with the design, implementation and interpretation of such surveys under similar conditions.

Dung-based methods

Dung-counts have long been used to estimate relative abundance or population density for large herbivores (Neff 1968, Putman 1984), and have been refined as a major survey method for African Elephants *Loxodonta africana* (Barnes and Jensen 1987, Barnes 1993, Barnes *et al.* 1997). Dawson and Dekker (1992) produced a manual on their use to estimate Asian Elephant population size, and methods specifically for wild cattle are being developed by S. Srikosamatara (Center for Conservation Biology, Mahidol University, Bangkok). Large carnivores produce too few scats and live at too low density for this method to be of wide use in estimating abundance, especially in the tropics where decay rates are high.

Dung-count based surveys have several problems. Difficulties of identification (sect. 4.2.1) mean that of the focal species, dung counts are only of use for Asian Elephants (at least until appropriate molecular techniques become available for identifying cattle species from their dung) and cattle (as all species combined; in Indochina no species of wild bovine is common, so demonstration of large numbers, even if the species cannot be identified, is important).

A problem fundamental with trying to convert numbers of dung piles into numbers of animals is that defecation rate needs to be known, but obtaining data on the defecation rate of free-living wild animals is very difficult. Even treating estimates of dung density as indices of relative animal abundance, the assumption that the defecation rate is the same in both areas or for both periods is needed, but is unrealistic if diets may be very different between areas or periods. Further problems can be caused by age- or sex-related differences in defecation rate (e.g. Neff 1968, Barnes 1979, Rogers 1987, Fuller 1991).

There are also serious difficulties associated with dung decay / disappearance rates. To interpret estimates of dung density from different areas, one either must make the totally unjustifiable assumption that decay rate is the same in all the areas, or must invest a lot of time monitoring decay rates of many known-age dung piles in all the habitat types surveyed in all the study sites. Furthermore, several decay-rate plots should be established (at different places and at different times) in each of the habitat types so that temporal and spatial variability in decay rates can be better dealt with. Measurements should be made both before and during the survey (not merely during or afterwards; Hiby and Lovell 1991). Monitoring enough cohorts of reasonable size for long enough (which most studies do not), one may well find that

decay rates are highly variable both spatially and temporally (e.g. Wiles 1980, White 1995, Barnes *et al.* 1997, Hedges and Meijaard in prep.).

Dung-based methods are rather time-consuming too, especially in dense forest containing few of the animals of interest. Adding to the logistical difficulties, cut transects cannot be re-used because wild cattle and elephants like nice clear paths through thorny scrub just as much as biologists do and this over-estimates dung density. More generally, animals tend to dung non-randomly in space and this requires a very large sampling effort to overcome (and causes problems when analysing and interpreting the data). The longer the period over which the data are collected, the greater the chance that the steady state assumption (that defecation rate, decay rate, and animal distribution do not change throughout the survey period, or at least if they do then they do so in a known manner) on which most dung-based surveys are based will be false.

Problems associated with surveyor skill (e.g. detection and correct classification of dung piles) need to be taken into consideration, as well as the question of what constitutes a single defecation event: many animals, including Asian Elephants, defecate while walking, which means that the boli of one event may be spread over a considerable distance; conversely, defecations may also lie on top of other defecations.

The errors resulting from the estimates of dung density, defecation rate, and decay rate may all be additive.

Dung-based survey techniques have been little used in Indochina, presumably due, at least in part, to one or more of the problems discussed above; for example in a recent survey in Vietnam too few elephant dung piles were found to estimate population density and S. Dawson (verbally 1997) was forced to relate the number of dung piles found to effort in a descriptive way. Santiapillai (1992) also recommended simple methods: e.g. derivation of indices of abundance by counting the number of dung piles found along animal trails and relating this to the distance walked or by dividing transects into blocks of equal length and scoring presence-absence of the species's dung (and other signs) in each block.

Despite their problems, such approaches warrant further development and several studies showed, through comparison with other methods, the potential of dung-counts as indices of relative abundance and population trend (e.g. Jachmann and Bell 1979, Koster and Hart 1988, Aulak and Babinska-Werka 1990, Mandujano and Gallina 1995, Varman *et al.* n/d). Nevertheless, the many problems associated with dung-counts make it necessary to repeat the cautions made about track-counts above, namely:

- They must be validated in Indochina before being adopted as standard survey techniques.
- Whenever possible two different methods should be used to assess population size or relative abundance (and the two should not rely on the same assumptions).
- Before any survey is conducted, the surveyors should consult with people familiar with survey design, implementation and interpretation under similar conditions.

4.2.4 Population estimation

Nowell and Jackson (1996), reviewing studies that sought to use signs to estimate cat populations, concluded that "in practice sign frequency is unlikely to yield more than an indication of relative abundance (e.g. high or low density population), and probably cannot be translated to a numerical estimate of population size". They stated further that "only detailed study, lasting several years and using biotelemetry, within a relatively small area ... is likely to yield an accurate estimate of population size".

While this statement ignores the potential of camera-trap-based estimates (see for example Karanth 1995, 1997, *in press a*) or multivariate analysis of footprint characters (see Smallwood and Fitzhugh's (1993) work on Pumas), none of these rigorous techniques has been validated in Indochina.

Ongoing camera trapping in the dense forests of Sumatra (Franklin *et al.* *in press*) is likely to be particularly relevant to the habitats of Indochina. A. J. Lynam (WCS-Thailand) is camera trapping in Thai areas with Tigers, primarily to assess human and environmental correlates of Tiger density. Karanth's (*in press a*) work from India suggests a threshold Tiger density (1-4 Tigers per 100 sq. km) below which camera trapping cannot estimate population densities. Populations over much of Indochina are already likely to be below this.

Focus on trying to estimate population size misses the point that for many conservation purposes, it is more important to detect population gradients in time and space (Karanth *in press a*): knowing whether an area contains 200 or 300 individuals is less useful than knowing whether the population is increasing, stable or decreasing, and how the density in the study area compares with adjoining areas, other potential conservation areas etc. For these purposes, only an index is needed. Even this may be difficult to generate unless the same people are used, or rigorous field guidelines are prepared and people of similar experience and motivation gather the data.

A. J. Lynam (*in litt.* 1998) feels that as it is barely possible to count accurately any focal species in any protected area, province or forest region, effort should concentrate on establishing presence-absence, which is of more value for managing individual areas; but as C. W. Marsh (*in litt.* 1998) points out, the need for a mechanism to rank areas in importance for the focal species remains.

National population estimates

Rabinowitz (1993) estimated the Thai Tiger population using broad categorisation of habitat quality with assumed Tiger densities. This method is crude, but stringent counting of Tigers in every Thai reserve would take so long that, on completion, early estimates would be unreliable: in conservation terms, too many Tigers would disappear during the census to make it an appropriate use of time. Rabinowitz's exercise was invaluable because future refinement of the base-line figure is possible, as the assumptions behind it are explicit. Most other work reviewed here quoting numbers gave no indication of their derivation, meaning that future changes in estimated numbers for the area could relate as much to changes in methodology or interpretation as to real changes in population.

No national population estimates have been made for any focal species in any country using transparent and scientifically credible methodology.

4.2.5 Censuses

In a census, the number of individuals of the species within a known area is counted; other approaches to estimate the population rely on sampling and then modelling. Censuses are demanding of time and resources and are therefore of questionable utility at this stage (sect. 4.2.4).

Track-based methods

Tracks cannot be used for censuses unless individuals can be identified from prints or track sets, ruling out their use of as a census technique for wild cattle and possibly elephants. Development of rigorous techniques for Tiger censuses may be possible using multivariate analysis of footprint characters, since this has been achieved for another large cat, the Puma (Smallwood and Fitzhugh 1993). Previous Tiger censuses using footprints supposedly identified to individuals were highly unreliable; however, as they were not conducted rigorously, were un-validated, and did not use multivariate analysis of track characters (see Karanth 1987), this past poor performance should not blind us to the potential power of these methods.

Nevertheless, these methods are time-consuming because of the needs for large survey effort, and detailed descriptions and measurements of prints and / or plaster casts. They will also need validation in an area with a known Tiger population (e.g. from radiotelemetry). These methods are best where the substrate takes fine detail of tracks well, e.g. in parts of Nepal and snow in Siberia (Miquelle *et al.* 1996; P. Jackson *in litt.* 1998). Little of Indochina is likely to be suitable, as the habitat resembles that in Sumatra, where Franklin *et al.* (in press) considered that prints and scrapes were found infrequently as a result of the heavy rainfall, thick leaf litter and hard substrate and, furthermore, were often of too poor a quality for precise measurement and classification. In Indochina, animal densities are so low that the survey effort required would be prohibitive in most areas.

Faeces-based methods

Faeces can be used for censuses only if individual animals can be identified from the DNA in their faeces. If they can be, then it is theoretically possible to census a given area by collecting faecal samples systematically throughout it and assessing individual identity until no new individuals are detected (Kohn and Wayne 1997). However, even with these molecular techniques sampling biases are possible. Recent work with seal faeces found that while most samples could be analysed, a significant proportion were recalcitrant; and it is possible that tractability relates to diet, sex or individual identity (Reed *et al.* 1997). K. U. Karanth and G. Amato (Wildlife Conservation Society) are currently investigating the applicability of this technique to Tiger censusing (Karanth in press a), and Prithiviraj Fernando (University of Oregon) is using the technique with elephants.

Non-applicable methods

Villagers' estimates of total numbers of a species in an area, extensively used in Indochina, have never been calibrated against a known population. This method should be discontinued. Village opinion on population trend is likely to be much

more accurate (and anyway is more important to know; sect. 4.2.4) than is their guess of the actual numbers involved.

Some workers in the region appear to use a form of cluster analysis of observed Tiger signs, assuming that each area with signs, separated from other such areas, represents a single individual Tiger. This has not been tested in Indochina and furthermore assumptions about Tiger spacing and home range use are inappropriate for today's dispersed and disrupted population. In view of the mobility of Tigers (as demonstrated by camera trapping; Franklin *et al.* in press) this method cannot be recommended.

4.2.6 Population trend

Population trends cannot be deduced from a single survey. Monitoring areas over time is needed (sect. 4.3). To understand recent past trends, villagers can be asked to estimate the local population remaining today as a percentage of that of 10-30 years ago (e.g. Steinmetz and Baird 1997). The technique has not been validated, but is based on accepted Participatory Rural Appraisal methods. Intuitively, it seems likely that useful information can be gained, particularly concerning high profile species (quarry species, or those threatening, valuable or extremely distinctive). As it would necessarily take decades to validate this method, and there will be no other way to establish recent population trends in the region, it should be used more widely, even in advance of validation; new users should seek advice from Robert Steinmetz (WWF Thailand) on pitfalls.

4.3 Monitoring of areas

Monitoring should be based on original surveys using repeatable methodology within the capabilities of the people undertaking the field work. For each area a fixed route should be decided, and covered once in each phase of a monitoring programme. The route should be precise and include particularly the water sources preferentially used by the animals and where signs are easiest to find. Very crude presence-absence-per block sign indices along transect lines are the most promising method (sect. 4.2.3). Disruptive effects of confounding variables should be minimised (see Karanth in press a). For example, the individual fixed route should be walked in the same month of each monitoring phase. Varying the months within the year would prevent monitoring as major changes in the numbers of signs found would be expected through differential (weather-related) durability of signs, changes in substrate and local animal movements.

Counting Tiger numbers by identifying prints to individuals is more useful for long-term monitoring than for baseline survey (sect. 4.2.5) but even so the needs for good substrate, skilled personnel and high levels of surveyor-time (O.-G. Støen *in litt.* 1998), and the additional constraint of the very low densities of Tigers in Indochina, limit the applicability of the method in the near future.

Smith *et al.* (1987) suggested that global Tiger numbers be monitored by a habitat-based Geographical Information System (GIS) as "by monitoring the quantity

and quality of Tiger habitat, changes in Tiger numbers can be tracked. The advantage of this method is that it requires fewer field skills than a complete Tiger census". The disadvantage, rendering it useless for tracking Indochinese populations of Tigers at the end of the twentieth century, is that Tiger numbers are related more to ungulate numbers and to direct Tiger poaching levels than to any readily remotely-measurable habitat variable; thus, Tigers are absent or declining in areas of suitable habitat (e.g. Karanth 1991, for India; extensive personal observation in Lao).

Habitat characteristics cannot predict hunting levels of either Tigers or their prey; therefore they cannot assess Tiger numbers. For a GIS such as the TCU system (sect. 3.1.7) to fulfil the vision of Smith *et al.* (1987), poaching levels of Tiger and ungulate prey base need to be fed into the model in a meaningful way and ground truthing of the causal effects of these on actual Tiger numbers is needed (see Karanth and Stith in press).

4.4 Presentation of survey and monitoring results

4.4.1 Accurate presentation of the survey locality

Reports of CPAWM/WCS surveys in Lao now include a gazetteer of all named sites (e.g. Davidson *et al.* 1997: 4-5), giving for each the season of visit, geographical co-ordinates, altitude, zone (of protected area / survey area) and survey methodology used. Such a gazetteer is needed in all survey reports. Administrative regions could usefully be included in it as well: surveys prior to protected area establishment frequently relate findings to administrative boundaries, and so comparisons with earlier surveys are eased if these are mentioned in later works.

Each individually significant record should have considerable detail including precise locality. Many past primate records are of limited value because it is unclear from which side of a major stream they came (Brockelman and Ali 1987). Dispersal of the focal species is limited by fewer geographical barriers, but precise localities are ever more important with the growth of Geographical Information Systems (GIS). Experience at the Center for Conservation Biology, Mahidol University, Bangkok shows that species accounts like 'recorded at three widely-spaced localities in and around the reserve' are much less useful for GIS than are individual records listed with precise co-ordinates (P. D. Round verbally 1998). To avoid cluttering text, the gazetteer should give co-ordinates for all sites with significant records. Global Positioning System (GPS) units able to give precise co-ordinates swiftly in the field are now readily available.

Reports need clear maps indicating:

- the geographical scope of the survey;
- locations of survey bases; and
- areas of intensive survey.

All maps should have co-ordinate grids and scale bars. UTM grids are less readily interpretable internationally than are co-ordinates. Expressing scales as ratios is

unsuitable as they lose their meaning when the map is reduced or enlarged on a photocopier.

4.4.2 *Dating of information*

Primary sources (e.g. survey reports) should give dates of field work. For village reports, dates of original sighting and when the information was relayed to the surveyor are both needed. Information should be dated accurately for several reasons:

- Imprecisely-dated status assessments hamper the assessment of trends in population. An estimate of, say, 35 Gaur in an area is of limited value if one cannot tell whether it is from 1990 or 1996 - or even, as seems possible with some estimates recently quoted, 1969! Precision is vital as numbers of species with high international value can change rapidly.
- The season is important, as the focal species may migrate seasonally. If the month is unavailable, at least the season (dry or wet) should be given.
- The interval between a reported sighting and the interview helps assess reliability; information fresh in the observer's mind is more credible than that from several years previously.

Data in secondary compilations are less useful if the compilation cites merely the date of the primary report rather than the fieldwork; they are useless if the source is omitted altogether (as it frequently was in the documents reviewed).

4.4.3 *The value of photographs*

Photographs (live animals, trophies, signs etc.) are objective evidence of survey findings, if properly labelled. They need therefore the same curatorial care as do biological specimens. An object for scale and a label indicating the date, locality, photographer and serial number should be included within the exposure (Wemmer *et al.* 1996), except with photographs of wild animals. Many modern cameras can print automatically the data and time on the exposure and this facility should always be used. As with specimens, over-collection is to be avoided as photography is expensive and preparation of appropriate labels takes time.

Photographs are already commonly taken, but, however, most prints seen lacked written details of origin on them, even on the back. They therefore lack value even before the photographer's death, after which most will become useless. Serial numbers referring to details of the exposure on a separate sheet of paper are not ideal due to risks of dissociation.

Foreign funders should pay photographic budgets only where grantees label their photographs and provide duplicates of important specimen photographs to the organisation. Survey executors have to see themselves when taking photographs not as contributing to their own personal photo-libraries, but as interim custodians of a timeless biological resource. The organisations should scan (or digitally transfer) the exposures onto computer for permanent storage.

4.4.4 The role of local language publications

All reports should be produced in the host language. It is difficult for local surveyors to develop report writing skills, if they work in a second language. This is the case even if a summary is produced in their own language. Furthermore, many people expected to act upon the recommendations of a survey (local staff) do not speak fluent English. This need is particularly pressing in Lao where the potential of survey reports to influence conservation activity and general policy is seriously compromised if they are produced only in English. The low proportion of reports translated thus far is probably a consequence of two factors:

- Translation is expensive.
- Translation is a highly specialised skill when the document contains numerous technical terms and is guided by outside concepts.

Ensuring that the translation reflects faithfully the original is best done by blind back-translation, even though this adds further to the expense.

Reports in local languages are not the entire answer, however; much of the desirable audience in rural areas simply do not use lengthy documents as a medium for provoking thought, discussion and action. Report circulation to these people should be accompanied by verbal presentations, in workshops and through personal discussions whenever possible.

4.5 Survey team composition

The calibre of results in many reports indicates the need for greater care with scheduling and assigning personnel for large mammal work in future surveys, particularly those of a multi-disciplinary nature.

4.5.1 Surveyors

Surveys intending to gather reliable information on the focal species need an experienced team member specifically dedicated to sign searches. S/he may need to move survey base faster than others in the team; a bird surveyor, for example, can cover the same ground repeatedly and still turn up new information, but once suitable areas around a survey base have all been checked carefully for signs once, moving to a new area is greatly more efficient (in terms of information gathered related to time) than re-checking the same ground.

Adding an extra surveyor to a team may prove unpalatable to funders. More seriously, in at least Lao, small numbers of foreigners are preferred: there are few appropriate Lao fieldwork counterparts and for administrative and other reasons the number of foreigners is best kept small. Thus, justification for the role of each external participant should be clear in the survey application (Venevongphet verbally 1998).

External technical assistance remains necessary for status surveys throughout Vietnam, Lao and Cambodia to achieve their full potential. Reports from surveys

without it all demonstrate considerable scope for local capacity building.

Specialists with suitable experience for the task are needed: surveyors may excel in some techniques but be weak in others. For example, one ongoing survey programme of Lao National Biodiversity Conservation Areas uses primarily people strong in direct field observation, rather than in systematic sign searches. Sign-based status assessments are correspondingly weakened: comparing the results of Duckworth *et al.* (1994) and Evans *et al.* (1996a, 1996b), using primarily the former, with those of Boonratana (1998a, 1998b), using mainly the latter, for Dong Hua Sao, Phou Xiang Thong and Phou Xang He NBCAs, demonstrates the utmost importance to provide a sign-based large mammal specialist.

4.5.2 *Local counterparts*

In the past, foreign surveyors often did fieldwork with local counterparts, but wrote the survey report alone. The legacy is severely under-developed in-country ability to write reports (let alone journal papers) to international standards. Reporting skills lag significantly behind fieldwork ability in Cambodia, Lao and Vietnam. Future surveys with external technical assistance should ensure fully collaborative data analysis and report drafting, despite the slower pace necessitated. Host governments should stipulate collaborative report-writing when granting survey permission, and international survey funding should be reserved for such work.

Local personnel involved in fieldwork should include those able to absorb technical skills and those responsible for implementing recommendations arising from the survey; often these are different individuals. The latter may include local-level representatives from the national administrative structure and protected area staff. Although they may never become proficient surveyors, they will better represent conservation in their various roles using knowledge and understanding gained by participating in a survey.

Where it will not compromise survey objectives (as it will not on sign surveys) students should also be taken in the field.

Imparting skills to protected area staff is important because they should spend much time in the field and, if motivated, are in the best position to monitor wildlife of the area. Time taken by survey teams to explain the background rationale of surveying and monitoring, and searching and identification techniques, may stimulate promising people who may not otherwise receive this. Not all protected areas have staff with great potential, but surveyors should remain vigilant for where a little investment may produce long-term results.

4.5.3 *Specific bodies in the region*

Surveys in Yunnan Province should involve a research institute with technical expertise (e.g. the Kunming Institute of Zoology) and a statutory body with responsibility for design and implementation of management activity (e.g. the Yunnan Forest Bureau).

Surveys in Lao should be conducted through or with the close liaison of Centre for Protected Areas and Watershed Management (Department of Forestry, Ministry of Agriculture and Forestry), which has statutory responsibility for national wildlife

survey and management issues.

Surveys in Cambodia should involve both the Wildlife Protection Office of the Department of Forestry and Wildlife, and the Department of National Parks and Conservation of the Ministry of Environment.

Surveys in Vietnam can be approved and implemented through a number of agencies; the one most appropriate depends on various factors including the intended use of survey findings. The three major bodies are:

- The Forest Protection Department of the Ministry of Agriculture and Rural Development, responsible for protected areas management.
- The Forest Inventory and Planning Institute (of the same ministry), responsible for preparing protected area management plans and for environmental monitoring.
- The Institute of Ecology and Biological Resources, a scientific institution that contributes data to (e.g.) the protected area management system.

All outside survey bodies should have advance direct dialogue with local (provincial / district / protected area) personnel; if this is impracticable, then central government bodies should play this role. Advance discussion, preferably with a reconnaissance visit, is particularly desirable in Lao, because of its decentralised administration; several recent foreign-instigated surveys arrived with letters from Vientiane to conduct work in protected areas whose staff had no prior warning; the latter therefore felt ignored (R. Steinmetz verbally 1998). This hampers planning; more gravely, such neglect does little to raise the self-image of the local staff (see sect. 5.1.1).

4.6 Research into existing traditional beliefs

In some of Lao, traditional beliefs may stall some people from hunting the focal species (e.g. WCS 1995c, WWF/Burapha 1997, Steinmetz 1998a). Beliefs may have been even stronger for rhinoceroses: Lao Theung people believed that attempting to capture or kill them was "tantamount to disaster" and that speaking the name (*het*) could precipitate unfortunate events (Neese 1975). Some people not only refrain from killing and eating certain species, but even forbid remains in the house (WCS 1995c). Conversely, Beck (1884) claimed that Lao villagers "like to eat Tiger meat because it makes them strong". This is not representative of many villagers today, perhaps indicating merely that today's pattern is enforced by the present rarity of Tigers.

Most indigenous Yunnanese will not kill or harm Asian Elephants or Gaur; they believe they are powerful, usually benevolent, spirits which will however punish those who harm them; furthermore, local people are reportedly not oblivious if outside people kill or harm Gaur in their area. Past frequent incursions into the Xishuangbanna prefecture by people killing Gaur and cutting large trees (which also hold spirits) make local tribes receptive to a reserve which promotes the protection of large mammals and trees (Wu Zhaolu verbally 1998).

Similar beliefs are held by some people in Cambodia, particularly the ethnic Lao in Stung Treng Province and elsewhere (Lic Vuthy verbally 1997).

Today's perilous status of the focal species indicates that the overall benefit to their conservation from these beliefs has been slight, probably because in any area most poaching is done by a small minority of people and it makes little difference what the remainder, the majority, think. Thus, once there are technical means and economic incentives to exploit the species, they are killed, and, despite the beliefs, not one site in Indochina today has a healthy population of Tigers using the same resource area as a large number of people.

Building upon these beliefs may yet help the focal species: siting a conservation project where most of the local population claim not to kill them may be more successful than siting it where there is no such cultural predisposition.

Steinmetz (1998b) discussed why local traditions approximating to resource conservation should be taken into consideration. Local conservation may be direct (stipulated regulations) or indirect (traditional norms of behaviour or spiritual practices / beliefs). These are starting points for collaboration between protected area staff and local people; provide insight into local perceptions and practices of conservation (allowing awareness building to be better structured), and can potentially be expanded to other sites, habitats and species.

As with interviews for wildlife status (sect. 3.2.4), to gather meaningful information on this topic, researchers need strong language and cultural skills. Specific research should consider:

- Are the species all linked, or is their selection discretionary in the person's mind? Which, if any, other species are protected?
- Is the belief linked with ethnic origin, geographical locality, or other factors, or is it chosen independently?
- How do people react to activities of others not following the philosophy?
- Does a person follow the philosophy for life or only at certain periods?
- Has the extent of belief changed in recent years?
- Tiger, elephant and wild cattle are all used as emblems on various Lao commercial products. Is this linked with this philosophy?

4.7 Incidental record gathering

Surveys for the focal species should use appropriate staff and methodology (sects 4.2). Consideration should be given to designing and distributing an incidental records form to people going in the field for other reasons, to maximise the opportunities of gathering information on the focal species.

Official links could be forged between the competent government agency and people such as:

- Joint Task Force-Full Accounting Program of the USA government;
- companies making oil and mineral exploration forays;
- demining groups;
- logging operation staff;

- others as appropriate.

In all cases, bias due to the individual interests should be borne in mind when interpreting results.

4.8 Record keeping and information dissemination

Better information storage systems are needed in all countries. Problems of dissemination (sect. 3.2.8) should be soluble by stronger administration and realistic budgets for report production and distribution. Particularly with respect to Vietnam, funding bodies should strive to educate their grantees that they are generating information for general use, and that those suppressing their results are hindering wildlife conservation. This could be helped by inserting a clause in the grant contract that the recipient is required to make freely available and to disseminate actively the information gathered (W. G. Robichaud *in litt.* 1998).

Copies of all reports should be formally lodged with one or more nominated government bodies and with one or more NGOs in each country. If multiple collections are made, each should be comprehensive. Appropriate NGOs include:

- IUCN, WCS and WWF in Lao;
- WWF in Cambodia; and
- WWF, FFI and BirdLife International in Vietnam.

These organisations should make available the information to any interested party.

Additionally, copies of all reports and papers should be lodged in a second country in a long term archive; the World Conservation Monitoring Centre, Cambridge, U.K. maintains extensive collections organised both by species and area.

For Asian Elephants, the Asian Elephant Research and Conservation Centre (sect. 6.8.2) would appreciate copies of all reports for its collection (R. Sukumar *in litt.* 1998).

For wild cattle, all information should be forwarded to Simon Hedges, Co-chair IUCN/SSC Asian Wild Cattle Specialist Group, c/o 19 Anne Crescent, Tower View, Barnstaple, Devon EX31 3AF, U.K.

4.9 Information from specimens

Clarifying the taxonomy of Tigers is hampered by the paucity of material with adequate provenance (e.g. Kitchener *in press*). The intraspecific taxonomy of the region's wild cattle is also unsettled (e.g. Srikosamataru and Suteethorn 1995, Hedges *in prep.*). Understanding taxonomy, in particular the patterns of variation with locality, is an essential underpinning of conservation (Cracraft *et al.* 1998, Kitchener *in press*), so increasing the number of specimens (skins, skeletons, tissue samples) available is a high priority.

Individuals of the focal species should not be killed for this purpose, but, whenever possible, specimens with certain locality data should be incidentally acquired and deposited in recognised research institutions. Kitchener (in press) urges for a worldwide database on Tiger specimens to be maintained, possibly with the National Museums of Scotland taking a lead role. All bodies should collaborate by providing details of the specimens held in their collections. Similar ventures for Asian Elephant and wild cattle would also be useful.

4.10 Research into ecology and population biology

Management of focal species would be enhanced by a clearer understanding of their ecological needs and life-history characteristics. Such work would be an excellent research topic for people from the region during higher degree courses. If the primary investigator is from outside the region, a counterpart researcher should be trained during the programme, with the schedule allowing a real opportunity for skills transfer.

Detailed research is of lower priority than are presence-absence surveys across the entire region. Important exceptions include understanding ranging patterns and population linkages in areas where major land-use changes are proposed.

The most important academic output would be the design and validation of repeatable survey methodology to be used as a regional standard. As yet, techniques in use, or suggested, have been little validated (sect. 4.2).

4.11 Preparation of a survey techniques manual

"It may only be a slight exaggeration to say that there are as many methods of counting Tigers as there are people out in the woods counting the beasts" (Karanth in press a). This lack of consistency hinders planning and prioritisation of conservation action. There is a clear need for simple survey techniques to be standardised across the region. Numerous problems are also caused by low-calibre surveys and write-ups (sects 3.2.3, 3.2.5).

To combat these problems and to lay a firm basis for local capacity building, a simple, concise, easy-to-use manual for survey and monitoring techniques should be compiled and made available in English, Lao, Vietnamese, Khmer, Chinese and perhaps other languages, with explicit guidelines on:

- how to design a field survey;
- how and what to record in the field;
- how to identify the signs of the focal species, and clear statement of when this is not possible;
- how to present and discuss the results in the report;
- appropriate cautions on the dangers of extrapolation.

Sign-based and interview surveys should both be covered. Few research papers have discussed the strengths and weaknesses of interview techniques; popular overviews are available (e.g. Barnett 1995: 38-41) but writing this part would probably require some original synthesis.

The manual should minimise the amount of contextual material explaining the genesis of the recommendations, as this is more presentable through workshops and in field training.

The methodology recommended should be suitable for use by local protected area staff, so such a manual should be produced in advance of the considerable research necessary to validate population index survey techniques and others too complex for widespread use at the local level (sects 4.2.3-4.2.5).

4.12 Socio-economic survey needs

Results from status surveys of the focal species can only be translated into conservation management action if there is a clear understanding of the socio-economic status of the human communities residing in and using the area. If this topic is researched insufficiently, there is a very real danger that recommendations will be made which have no chance of success. Human settlement and use patterns, and local aspirations, set major constraints and offer some opportunities to management options. The current authors are not competent to review work to date in this field, nor make recommendations concerning future activity. However, we do note that such information is as important for conservation planning as is an understanding of focal species status. Furthermore, while socio-economic surveyors are likely to have very different fieldwork scheduling needs from wildlife surveyors, and constraint to work together would be counter-productive (sect. 4.5.1), very close dialogue is needed between them.

PART 5: RECOMMENDATIONS FOR PROTECTED AREAS

5.1 Protected area design

All four countries have an extensive protected area network declared. The current momentum for the formal establishment and strengthening of protected areas and identification of habitat-linkage corridors between them should be maintained. Any unprotected area in any country found to support potentially healthy numbers of any focal species should be considered for some form of protected area status, particularly if Banteng or Tiger are concerned. Any site supporting rhinoceroses, Kouprey, wild Asian Buffalo or Asian Tapir should be accorded protected area status immediately and management implementation is urgent.

Human settlement is inimical within focal species home ranges, and human re-settlement is often expensive and has many negative consequences; it should only be a last resort (e.g. Saberwal 1997, Karanth and Madhusudan 1997; see also sect. 5.10.3). Every effort should be taken to forestall human settlement within likely future conservation areas for the focal species.

5.2 Habitat types within protected areas

Optimal habitat for Tiger tends to be large blocks of lowland forest with some open woodland and grassland, crossed by many streams with associated dense forest; densities are lower in evergreen forest, mountainous areas or fragmented habitat (Borner 1978, Sunquist 1981, Seidensticker 1986, Santiapillai and Ramono 1987, Seidensticker and McDougall 1993). In India, mixed deciduous forests (with water) and moist deciduous forests probably support much higher Tiger densities than do closed-canopy evergreen forests (K. U. Karanth *in litt.* 1998).

Habitat choice has not been studied in Indochina, but as the overall causal factor elsewhere, greater biomass of large ungulates in the favoured habitats described above (Seidensticker and Suyono 1980, Sunquist 1981) is likely to hold also in Indochina, it is reasonable to prioritise action here to large lowland areas with much relatively open forest, over smaller, montane or closed-canopy areas. Since lowlands are also favoured by people, they are often more imminently threatened than are large montane forests, which are less easy to clear, farm and settle.

Asian Elephant and Gaur occupy many forest habitats but densities are also likely to be higher where some parts of the canopy are broken, grassy glades are present and surface water is well distributed. Banteng may have the most restricted habitat use, being most numerous in open deciduous forest, such as dry dipterocarp forest (Hedges *in prep.* and references therein). Surface water is also important. In Indochina, these habitats are predominantly in flat areas. It is unclear whether substantial numbers of Banteng occurred in the more closed and evergreen forests

covering much of Indochina's hills and mountains (sect. 3.1.4).

All focal species can tolerate some degradation of habitat structure (sect. 5.7); the major feature for them implicit in the phrase 'optimal habitat' is a comparative freedom from people. This may best be termed a 'wilderness area', viz a large expanse of land with no or low settlement, farming activity and vehicular access (sect. 5.6), and a relatively natural mammal species assemblage. The sheer size is also an important component of habitat quality (sect. 5.3) as wildernesses smaller than a certain size and isolated from other such areas are unlikely to be able to support the species. Habitat 'management' in Indochina for the focal species consists primarily of recreating wilderness by reducing human settlement and activity.

Elsewhere, where numbers are closer to environmental carrying capacity than in Indochina, wild cattle can respond favourably to the creation of clearings in forested areas: for example in Alas Purwo National Park, East Java, artificial clearings created in the early 1980s seem to have led to a pronounced increase in the number of Banteng (although there has subsequently been a Dhole *Cuon alpinus*-driven decline). Such habitat management has great potential for boosting the ungulate carrying capacity of forested reserves and parks in the long term, but, however, it is unlikely that in any area of Indochina wild cattle numbers are being limited by habitat features rather than by hunting. Once hunting issues have been addressed and there are locally secure areas, active habitat management should be considered; prior to this, it would probably make little difference.

There is insufficient study to understand critical habitat features for the focal species, so whether populations can survive in areas devoid of old-growth forests is unclear; while they certainly use degraded habitats extensively, these may be overflow areas from better quality habitat. Furthermore, these long-lived animals may survive as 'ghost' populations well after environmental disruption prevents regular successful breeding.

Equally, it cannot be concluded (hypothetically) that if hunting were curtailed, habitat conversion could continue headlong. The level of degradation beyond which the focal species would not thrive is unknown in Indochina, but there is clearly likely to be a threshold.

5.3 Protected area size

Very large areas are needed to conserve the focal species. Home range size has not been studied in the region, so comparative information is drawn from elsewhere:

- Annual herd range of Asian Elephants in Sri Lanka and southern India varies from 50 to 500 sq. km (Fernando 1997).
- Preliminary research suggests that an area the size of Xe Pian National Biodiversity Conservation Area (Lao; about 2400 sq. km) can support several herds of Gaur year-round (R. Steinmetz verbally 1998).
- Tiger territory size depends on the habitat and prey base. Of the estimates of Tiger density listed by Nowell and Jackson (1996), the most comparable for use in

Indochina is from Huay Kha Khaeng Wildlife Sanctuary (Thailand) which supports one Tiger per 100 sq. km (Rabinowitz 1989). Tigers in Indochina are spread even more thinly than in Huay Kha Khaeng as ungulates are scarcer than in this (relatively for Indochina) well protected area, even though the latter itself has prey densities well below carrying capacity (Rabinowitz 1993, Srikosamatara and Suteethorn 1995).

Thus, realistic conservation of these species needs dedicated areas of hundreds of square kilometers. For the reduced populations in the evergreen habitats of much of Indochina, reserves may need to exceed 3000 sq. km (Karanth and Stith in press).

These numbers are arithmetically convenient cut-offs with no empirical derivation, reflecting the simple relationship that larger areas stand higher chances of protecting populations. Work with another large cat, the Puma, found that without dispersal corridors, long-term conservation areas for them should exceed 2200 sq. km, but even corridors allowing movement of a few individuals per decade meant that areas of 600-1600 sq. km were valuable (Beier 1993). In Indochina, only Lao protected areas routinely exceed 1000 sq. km but the conservation reality of these National Biodiversity Conservation Areas is unclear until core areas are designated (sects. 3.1.6). Several protected areas in Cambodia also exceed 1000 sq. km. In Vietnam, most are far smaller; high human population density there restricts the expansion of protected areas although some notable advances have been made and more are being pressed for.

5.4 Landscape-level area designation

Tiger Conservation Units (Dinerstein *et al.* 1997) are typically much bigger than any protected areas they contain. Managed large mammal ranges, using the concept of India's Project Elephant Reserves, may offer important possibilities for conserving Tigers in Indochina at today's prey densities, and the best for Asian Elephants and wild cattle. Large areas (2000-3000 sq. km or more) are needed within which activity bows to large mammal management aims. Critical areas (e.g. saltlicks, aggregations of permanent waterholes, areas concentrating animals when food availability is low) should be within totally protected core zones (sect. 5.10.3). Action in Indochina should first form and consolidate well-protected core zones; even in India, the concept of large areas managed for elephants is still experimental and all activity within them does not yet defer to large mammal management needs (V. Menon *in litt.* 1998).

5.4.1 Corridors

Corridors between protected areas need designation to allow animal movement between these areas. For animals living at low density such as the focal species, two protected areas supporting closed populations may well provide, in total, less assurance for long-term conservation than would the one effective population produced in the two areas if a dispersal corridor between them were maintained.

A new nature reserve for wild cattle in Vietnam

Ea So is one of few areas in Vietnam retaining high ungulate numbers. These include at least 20 Banteng, one the most threatened very large mammals in the world. Surrounded by agricultural land and villages, however, the area is very attractive for economic development. Because of its rich pasture, it was even proposed recently as suitable for commercial cattle farming. Adjacent to the provinces of Gia Lai and Phu Yen, the area is subject to illegal animal hunting and forest cutting by the ethnic minorities from these areas. Yet despite this importance and level of threat, until recently no investment or plan was made to conserve the area.

After a 1997 large mammal survey and subsequent workshop in the province on the conservation importance of the area, on 30 May 1997 the People's Committee of Dak Lak Province passed Correspondence No 920/CV-UB, regarding the management, protection and establishment of North East Ea So forest area. The initial responsibility to establish a forest protection and management station, and initiate activities in the area, was given to the provincial Forest Protection Department by the provincial governor. On 26 July 1997, the provincial FPD passed Decision No 321/QD-KL regarding the establishment of North East Ea So Forest Protection and Management Station and the implementation of the following responsibilities:

- Publicise the area's importance, including its many rare and threatened animal and plant species in need of protection. Erect signs and otherwise demarcate the area.
- Manage the forest and its resources, based on sound knowledge of the local situation.
- Control people and vehicles within the protected area. Patrol to prevent illegal forest cutting, and bird and mammal hunting.
- Check for and stop all other activities harmful to the forest resources. Prevent free immigration into the protected area.

After establishing the guard stations, several activities in protecting forest resources and preventing hunting have already been effective. Since biodiversity conservation in North East Ea So is in the interests not only of Vietnam but also for the world, to transform North East Ea So to a fully functioning nature reserve, Dak Lak provincial Forest Protection Department proposes the following:

1. Central bodies such as the Ministry of Planning and Investment, the Ministry of Agriculture and Rural Development, and their branches at the provincial level, should invest as soon as possible in conserving the area and strengthening management capability.
2. Immigration of people to this area, including the buffer zone, must be stopped.
3. International organisations should join the province's efforts, by contributing financially to:
 - construction costs for staff houses and outstations
 - facilities for the guards such as motobikes and running expenses
 - a subsidiary fund for resettlement of households.

Tran Minh Hien, WWF Indochina Programme

Box 1: establishing a new protected area is a complex undertaking and takes time, but political will is currently high in the region.

Promotion of corridors is based upon computer simulations and intuition. Although there may be negative sides to corridors (e.g. disease transmission), conservation planners should act in advance of empirical validation of the corridor approach; by waiting, many opportunities will be lost, and those remaining may cost considerably more.

The Forest Department of Yunnan Province's proposal to the Xishuangbanna Prefecture to protect land between Mengyang and Mengla (two disjunct parcels of Xishuangbanna National Nature Reserve) is stalling for lack of finance (Wu Zhaolu verbally 1998). As the elephant population of Mengyang is increasingly isolated but reportedly growing, linking Mengyang to Mengla and thus to Lao is important. Most proposed corridors in Indochina are important for long-term gene flow; this one is urgent to allow free dispersal of a stressed population. Linking Xishuangbanna National Nature Reserve to any other area is unrealistic.

The 1995 recommendations for the Lao National Biodiversity Conservation Area system (Berkmüller *et al.* 1995a) gave clear consideration to the importance of linking existing NBCAs. One incentive was their role in large mammal conservation (see e.g. Duckworth *et al.* 1994):

- New NBCAs (Xe Khampho, Bolaven Southwest, Bolaven Northeast and Phou Kathong) were proposed to link the existing trio of Dong Hua Sao, Xe Pian and Dong Ampham.
- The Annamite flagship NBCA Nakai-Nam Theun was proposed to receive a large northern extension, and corridors to Khammouan Limestone and Hin Namno NBCAs.

These 'corridor' NBCAs so far lack reality on the ground or in cross-sectoral planning; they should be formally gazetted soon. Irrespective of speed of their designation as protected areas, these corridors should be priority areas for large mammal conservation activity.

Additionally, Nam Kading NBCA should be provided with corridors southeast to Khammouan Limestone NBCA and north to Nam Chouan proposed NBCA (WCS 1995e, Timmins 1997).

Other Lao NBCAs lack obvious opportunities for corridors. The short gap between the Phou Xiang Thong and Xe Bang-Nouan NBCAs is too heavily settled for there to be significant movement by large mammals between the areas.

Suggesting corridors for large mammal dispersal in Cambodia and Vietnam is difficult because recent detail on mammal status is scanty. Two general recommendations can be made:

- Areas of limited human settlement which could link existing protected areas should be investigated.
- Areas with low human settlement densities are more important than perceived 'good' habitat, if the latter is close to settlement (see sect. 5.2).

5.5 Appropriate boundary delineation of protected areas

It is beyond the scope of this document to discuss the boundary decision process, but two issues are of overwhelming importance to the focal species.

5.5.1 *Dangers of the use of natural features*

Use of easily observable natural features, notably rivers, as boundaries is highly disadvantageous to large mammals and indeed to wildlife conservation as a whole. Their use for demarcation is tempting as manual creation and maintenance are not needed, and they are unambiguously understandable to local people. But, ecotones, particularly streambanks, are among the most important parts of a protected area and need protection in their entirety. Riverine forests are productive feeding grounds for ungulates (and therefore Tigers) and amid open forest (e.g. dry dipterocarp) they provide daytime retreats (e.g. Wharton 1957). Thus, protected areas should extend at least 1-2 km across rivers and streams.

The proposed realignment of the Yok Don National Park boundary north from the Srepok river to the Chu Mulanh road (Yok Don National Park 1998; Tran Minh Hien verbally 1998) extends the park and is of particular benefit as the Srepok, a river of major importance (Le Xuan Canh *et al.* 1997b) now flows through the park, not beside it. This excellent achievement should be emulated wherever possible throughout the region; there is plenty of scope in at least Lao (Duckworth *et al.* 1998).

The boundary should be formulated in consultation with local people and during this process, certain areas may become clear where, for unambiguity, a watercourse should be used (Venevongphet verbally 1998); these areas should be kept to a minimum, and the justification should be clear.

5.5.2 *Dangers of increased access*

Boundaries should not facilitate access for hunters and other illegal users of protected areas (see sect. 5.6). Cutting a ride through the habitat along the margin of a protected area gives an unambiguous boundary on the ground, but it also helps people to enter and to hunt animals.

5.6 Access to protected areas

Most areas in Lao, Vietnam and Cambodia retaining important numbers of the focal species do so because their remoteness limits people's entry and use of the area. Only rarely (e.g. Sangthong District, Vientiane; Duckworth 1996a) do prohibition and enforcement seem to maintain populations of species with high trade value in accessible areas. Capability for patrolling and other active management of protected areas is developing within the region, but until there is a committed and capable workforce, the best protection for protected areas remains their inaccessibility. Building roads and otherwise easing access to wilderness areas is absolutely inappropriate.

A road was built into the heart of the evergreen forest in the enormous montane Nakai-Nam Theun National Biodiversity Conservation Area in 1993 or 1994, but was not used for *Fokienia* logging, its intended purpose. A visit in early 1996 found many confiding large mammals, including the only post-1970 sightings of Tiger (and several other rare species) in Lao by biologists; the road was little used by local people for any purpose. In early 1997, people were gathering products, including wildlife, daily and few of the rare large mammals, so readily observable only a year previously, were seen (Tobias 1997, Duckworth in press). Opening up remote habitat in any protected area in the region will probably have similar results.

Indeed, at Cat Loc Nature Reserve (critically important for its Javan Rhinoceroses) "settlement is being stimulated by the construction of roads and other facilities in the ... reserve" (van Strien 1998).

Elsewhere in South-East Asia, protected area management is hampered by agricultural encroachment and logging, both facilitated by road construction (Wells and Brandon 1993). Massive forest loss in the Philippines was triggered by the construction of roads to carry rural produce to urban markets, which simultaneously carried urban labour (as loggers and settlers) to rural areas (Liu *et al.* 1993). Even trails cut to enable wildlife research may facilitate wildlife hunting (e.g. in Korup forest, Cameroon; Alpert 1996). These happenings are probably widespread in Indochina but case studies of cause and effect are lacking.

5.7 The importance of reserve buffer zones, logging concessions and other surrounding habitat

"Previous status assessments of Tigers ... undervalued the contribution of degraded, secondary forest / grassland habitats as potential refuges" (Franklin *et al.* in press). Such areas are valuable to the focal species for several reasons:

- If hunting is controlled, they can support many elephants, ungulates and the carnivores that prey on them. For example, various ungulates and many Tigers live in the heavily logged Way Kambas National Park, Sumatra (Franklin *et al.* in press). Nam Phoun National Biodiversity Conservation Area (Lao) holds exceptional numbers of Asian Elephants and important populations of Gaur and Tiger (Boonratana 1997, 1998b) in an area largely of bamboo with very little dense forest (C. W. Marsh *in litt.* 1998). Grazing animals have more food in open forest because of the lush field layer compared with closed-canopy evergreen forest (e.g. McNeely 1975, Eisenberg and Seidensticker 1976, Karanth 1991, Karanth and Sunquist 1992, Seidensticker and McDougal 1993). Logging in the Ulu Segama Forest Reserve, Sabah, increased the browse within reach of small to medium-sized ungulates, and muntjac densities did not drop; and although densities of the frugivorous mousedeer *Tragulus javanicus* and *T. napu* decreased (Heydon and Bulloh 1997), these are too small to be favoured Tiger prey.
- The focal species need certain, geographically dispersed, habitat features, some of which may lie outside core zones.

- They live at low densities, so buffer zones are important simply to give a larger area and, by extrapolation, a larger population.

Management of areas outside core zones for the focal species should include armed anti-poaching patrols (sect. 5.10.4) and, if Tigers occur, measures to maintain ungulate populations (see sect. 6.2.1).

5.8 Trans-boundary linkage

Protecting within one province the very large areas the focal species need may limit provincial development options. A less restrictive way to protect the same extent is for adjacent provinces to abut their protected areas; there is also a shorter total boundary to be managed than if the two areas are separate. The same principles can be applied internationally, with a further advantage: should protective measures falter in one country, areas in adjacent countries can act as mid-term refuges allowing eventual repopulation after active protection has been re-established (Weber and Rabinowitz 1996).

Vietnam and Yunnan Province have few self-contained very large areas to be set aside for wildlife. Their best options for conserving the focal species consist of trans-boundary reserves with Lao and Cambodia.

Protected area philosophy and management ability is evolving in the region. Joint international management would lead to a markedly more complicated decision process, slower action and perhaps fewer achievements through a variety of incompatibilities (see e.g. Hamilton *et al.* 1996: 6-7). The two sides should engage in ongoing dialogue to aid understanding of each area's management needs.

The ongoing UNDP-funded Trans-boundary Biodiversity Forum, executed by WWF, is therefore developing the importance of trans-boundary areas through parallel (rather than joint) conservation initiatives. A focus on parallel development:

- is more palatable to sovereign governments;
- allows each state to proceed at the most suitable pace;
- promotes a dialogue of sharing rather than attempts at dominance.

Building on existing local-level initiatives (e.g. discussion between Salavan (Lao) and Quang Nam (Vietnam) Provinces) is likely to achieve more real dialogue than would centrally-imposed 'collaboration' (R. Steinmetz verbally 1998).

The following areas merit linkage based on their importance for the focal species. Action is most urgent where expanding the protected area in one or both countries is necessary to give a sufficient common border:

- Shangyong (Xishuangbanna National Nature Reserve, Yunnan Province) and Nam Kong Provincial Protected Area (Lao);
- Phou Dendin National Biodiversity Conservation Area (Lao) and Muong Nhe Nature Reserve (Lai Chau Province, Vietnam);

- Nam Phoun NBCA (Lao) and Na Haew National Park (Loei Province, Thailand). Na Haew has good numbers of Tigers (A. J. Lynam *in litt.* 1998);
- Nam Chouan proposed NBCA (Lao) and Pu Mat Nature Reserve (Nghe An Province, Vietnam); Nakai-Nam Theun NBCA (Lao) and Vu Quang Nature Reserve (Ha Tinh Province, Vietnam); Hin Namno NBCA (Lao) and Phong Nha-Ke Bang Nature Reserve (Quang Binh Province, Vietnam): these six areas are all close together;
- Phou Kathong proposed NBCA, Dong Ampham NBCA (Lao), Chu Mom Ray Nature Reserve (Kon Tum Province, Vietnam), Xe Ghong Provincial Protected Area (Lao) and Virachey National Park (Cambodia); note that this complex is linked to the Xe Pian NBCA complex of protected areas, forming a large region dominated by protected areas and corridors;
- Dong Khanthung proposed NBCA (Lao), Kulen Promtep Wildlife Sanctuary (Cambodia) and Phu Chong Nayoi National Park (Ubon Ratchathani Province, Thailand); and
- Snoul Wildlife Sanctuary (Cambodia) and Bu Gia Map Nature Reserve (Ninh Thuan Province, Vietnam); information from both areas is thin but survey would probably find the areas to be important for the focal species.

Several additional regions would benefit if adjacent land over the border were gazetted as a protected area:

- Mengla (Xishuangbanna National Nature Reserve, Yunnan Province) and Phongsali Province (Lao); the wildlife value of the latter is currently unclear;
- Xe Sap NBCA (Lao) and Thua Thien-Hue / Quang Nam Provinces (Vietnam); the proposed Song Thang-Dak Pring Nature Reserve in the latter province does not abut Xe Sap, but is contiguous with high-quality habitat in Hien District to the north, which does (E. Wikramanayake verbally 1997);
- Xe Pian NBCA (Lao) and Stung Treng Province (Cambodia); the wildlife value of the latter is currently unclear; and
- Yok Don National Park (Dak Lak Province, Vietnam) and adjacent Monduliri Province (Cambodia); the latter area is of confirmed high value for the focal species.

Phou Xiang Thong NBCA (Lao) lies over the Mekong from Pha Taem National Park (Thailand). However, the river is wide and the two areas may not support components of the same gene-pool. Even so, information exchange and joint initiatives to control poaching and for other management activities should be stimulated.

Mammal status information from the protected areas along the western border of Cambodia is too thin to tell which are important for the focal species and therefore might benefit from collaboration with Thailand.

No formally recognised protected areas seem to lie along the border of Burma with either Yunnan Province or Lao and large mammals are believed to be few along this border, at least on the Burmese side, because of over-hunting to satisfy the Chinese market demand through the border town of Shweli (U Tin Than *in litt.* 1998).

5.9 Management of small populations

There are few, if any, empirical studies of the hazards of in-breeding depression in the focal species: generation times are long and population manipulation is expensive. Proposed minimum viable populations (e.g. 300 for Tiger; Leyhausen 1986, 1000-3000 for elephants; Menon *et al.* 1997), or the theoretical calculations for Asian Elephants by Sukumar (1993) are merely estimates provided for guidance. However, small populations are more likely to need intensive management techniques to remain viable, such as moving animals between sites to increase gene flow.

A precautionary approach suggests that potential problems should be forestalled by concentrating on conserving large populations. The problems with moving Tigers around should not be under-estimated: the grim, hypothetical, result of an urgent translocation described by Wemmer *et al.* (1987) may not be too far from the truth. Linnell *et al.* (1997) concluded that translocating carnivores was rarely worthwhile, because of an almost insuperable suite of problems and very high cost (see also sect. 6.3.7).

Wild cattle are likely to be less difficult to move around as they are not territorial and foraging is simpler for them, and needs less specific knowledge of the home range, than is the case with large carnivores. It is unlikely in the foreseeable future that translocation will be an appropriate tool (as release areas must be free from significant poaching), so the full discussion of the topic in Hedges (in prep.) is not repeated here. However, few translocations of grazing bovids elsewhere have had adequate post-release monitoring (Novellie and Knight 1994), so it is difficult to predict likely problems, but they may include high post-release mortality (e.g. Hedges and Tyson 1994), disease transmission (e.g. Cunningham 1996), genotype-related issues (e.g. Sarrazin and Barbault 1996), stochastic effects on a small population and local attitudes.

Asian Elephant, because of the presence of tamed representatives of the wild gene-pool, may be the most amenable focal species to population manipulation. Research is needed on the behaviour of tamed elephants placed in the wild, to assess among other issues whether they can contribute gene-flow into small isolated populations (Daniel 1993); R. Mather (WWF Thailand) is currently engaged in related work, involving the tracking of released 'surplus' tamed elephants in Doi Pa Muang Wildlife Sanctuary, Lampang Province, Thailand. In the first five months, the five middle-aged females released have clearly been able to find water and food, interact as some form of social unit and have not come out of the forest looking for food and causing problems for visitors; there seem to have been no wild elephants in the area for 20-30 years (R. Mather *in litt.* 1998).

This complex topic is covered by guidelines in IUCN (1998) and any translocation or re-introduction proposed for the region should take note of all issues discussed.

Intensive management, such as translocation, has the further disadvantage that it prevents the species fulfilling any role as an indicator or umbrella species (Simberloff 1987, 1998), and compromises the benefits from their use as flagship species (see Afterword).

5.10 Protected area management policy

5.10.1 Integrated Conservation and Development Projects

Optimal management strategies to preserve the focal species will vary between protected areas. Innovative Integrated Conservation and Development Projects (ICDPs) may play a role, but before being embraced as the standard management technique it should be understood that, being relatively new, there is as yet little empirical support for their ability to conserve mammals. The initial successes of one such project in a Tiger area in Nepal (Royal Chitwan National Park; Dinerstein *et al.* in press; sects 5.10.3, 5.10.4), should be studied to see if outlook, methodology, and scale, are adaptable to Indochinese conditions.

Definition

A clear consensus on the definition of an ICDP seems lacking, presumably because the concept is new. Alpert (1996) stated that ICDPs set "a dual and equal focus on biological conservation and human development". Such projects may well exist, but if resources come from the conservation purse, the foci should *not* be equal: resources are for the former, involving the latter when they contribute to the former. Without this explicit recognition, wildlife conservation money may end up funding rural development ventures which come to be seen themselves as a desirable and justifiable end-product for the project: Oates (1995) documents just such a case. Alpert's definition is a dangerous development from the pragmatic conclusion of Wells and Brandon (1993), that addressing local people-protected area relationships is essential to the conservation of many protected areas because there is no other choice. A project to strengthen the management of a protected area should have as its clear focus addressing the challenges to the management of that protected area; and since the rationale for the protected area is biodiversity conservation, this aim should remain paramount in its management.

Pitfalls in practice

Robinson (1993), Southgate and Clark (1993), Wells and Brandon (1993), Durbin and Ralambo (1994), Kremen *et al.* (1994), Barrett and Arcese (1995), Gibson and Marks (1995), Oates (1995), Alpert (1996), Noss (1997) and Larson *et al.* (1998) all highlight pitfalls which need addressing when ICDPs are designed in Indochina, including:

- the role of buffer zones;
- ways to ensure true participation of local stakeholders, at all project levels;
- the timescale of external funding;
- the need for clear linkage of development to conservation achievements;
- the recognition that major threats to protected areas may originate from afar and be utterly outside the control of any local user-group;
- the need for ICDPs to co-ordinate with regional development to ensure that external funding does not actually attract people into the environs of the protected area, thus further stressing its resources;

- consideration to the sort of development to be promoted;
- ensuring equitable benefit distribution;
- challenges to working in ethnically diverse areas;
- attempting to ensure that economic benefits from the project's economic development activities exceed those from unsustainable, illegal, resource exploitation;
- various others.

In particular, ICDPs must guard against "wishful thinking about local communities' regard for natural ecosystems" (Southgate and Clark 1993) and avoid "an overdose of market-friendly humanism [which] is not a substitute for site-specific ecological analysis of the real impact of ... human induced, market driven disturbances on wildlife communities" (Karanth 1998). Without inseverable linkage of social / economic development to successful conservation activity, the former is unlikely to promote the latter. Few if any human societies aspire towards a pre-determined development standard, and arriving at it, leave off stressing resources; instead, further development is undertaken. This is an attitude at all levels, right from the basic: snare hunters "capture as many animals of any species, sex and age as they can ... [they] always want additional snares. Net hunts that are very successful are never cut short because enough animals have been captured; instead, hunters often push on longer because tomorrow might not be so successful" (Noss 1997). Failure to address this fundamental human trait will render an ICDP a potentially damaging development for a protected area.

No human communities in Indochina depend solely on hunting wildlife for subsistence; the activity is one facet of a mixed strategy of resource acquisition. Work outside the region shows that rural populations have little concern about declines in certain natural resources because such declines are not major problems: another activity can be increased in compensation. There is also, in some areas, the feeling that quarry conservation is irrelevant for the future because economic development will remove the need for hunting (Infield 1988, Kottak and Costa 1993, Noss 1997).

The underlying problem: sustainability is in few people's short-term interests

There is little evidence from existing protected areas across the world to suggest that local people habitually aim to keep any form of natural resource use sustainable (Wells and Brandon 1993), and subsistence hunters are best viewed as opportunistic predators, not conservationists (Hames 1991, Alvard 1994, Noss 1997). In the rare cases where sustainability is aimed for by local people, external (international) help in keeping outsiders from hunting may be requested (e.g. Bodmer 1994). Indeed, long-term security of land and resource tenureship is a prerequisite for an outlook of sustainability. In Lao, ownership is strongly respected, so people are cautious about killing or selling domestic animals, if by keeping them longer they will increase in value; by contrast, wildlife belongs to nobody and so if one group does not harvest a resource, some other one is likely to (Fernando in prep.); the perception is that the group to get in first will benefit most - and anyway a few years hence the whole area may be given out as a logging concession to a foreign venture (e.g. much of the Nakai

Plateau, Lao, is logged by Vietnamese companies using Vietnamese personnel). Who would seriously expect self-disciplined sustainable use under such circumstances? Gadgil *et al.* (1993) discussed this challenge further.

Sustainability is particularly unlikely with the focal species; with their high trade value, illegal harvesting would continue even if resource tenureship issues were resolved legally. Only if these species were perceived to funnel substantial money into community economies might these communities try to protect their animals.

Tourism is the most likely way for this to happen, yet levels are too low in Indochina to bring widespread benefit in the near future. The many problems in funding protected areas through tourism (Wells and Brandon 1993: 161) would not be insuperable with adequate planning and high-level political support. In particular, there are widespread problems in channelling tourism revenue to those bearing the opportunity costs to preserve the features attracting the tourists. Brandon (1996) reviewed this topic.

Tourism is helped by high biodiversity and aesthetic settings. Other factors which facilitate ICDPs are (Alpert 1996, from review of African ICDPs):

- political support from the national government;
- remoteness (especially, limited access to open markets);
- local economic poverty;
- low human population;
- amenable local traditions; and
- active commitment from specific influential individuals.

Some of Indochina is certainly remote, sparsely inhabited and poor, but frequent hunting is an ingrained local tradition, and the political support for curtailing it necessary at all administrative levels is likely to be rare. Even in Africa, the most common conflict between local residents and conservation involved hunting (Alpert 1996), indicating that in Indochina considerable spadework will be necessary for ICDPs to play a role in the conservation of the focal species. The challenge is to attain this level before the remoteness of the best remaining areas is lost (sect. 5.6).

5.10.2 *The need for monitoring management progress*

No management strategy, whether or not it uses ICDP principles, is likely to be successful unless it includes a biological monitoring programme which can evaluate project progress. Monitoring is especially needed for ICDPs as they remain unvalidated as a tool for wildlife conservation in South-East Asia. Indeed, "unprecedented rigor in the design, implementation, and interpretation of ecological monitoring will be essential to provide the necessary guidance" (Kremen *et al.* 1994). Four years hence, most ICDPs in the region still lack scientifically credible internal assessment of success.

Many ICDPs' plans for research and monitoring are typical casualties of project restructuring, belt-tightening and other ongoing 'refinements' (Alpert 1996). Wells and Brandon (1993) concluded that some ICDPs had such a hazy idea of their own progress that there was "some confusion between what has been planned and what

has been achieved"! Pressures on the focal species are so high that shoddily designed projects may hinder their conservation rather than help it.

5.10.3 *The need for inviolate cores zones*

Currently, the main challenge to protecting the focal species is to initiate motivated protection of quarry species, using force where necessary, in core zones, which "may provide the only safe long term refuge from poaching, habitat degradation and prey loss" for Tigers (Tilson and Nyhaus 1998). They do not do so yet in Indochina.

Karanth and Madhusudan (1997) judged that the Tiger situation in India is too critical (in Indochina it is even graver) for the long-term potential of community-driven ICDPs aiming for natural resource sustainability to replace short-term enforced protection. Very rarely can ICDP-style local participation substitute for guard patrols and effective policing (Wells and Brandon 1993), least of all to protect high-value species in Indochina. Even in Royal Chitwan National Park (Nepal), central to management success is the core area of over 1000 sq. km under strict protection by the army, who are empowered to shoot offenders (K. U. Karanth *in litt.* 1998).

Patrolled core zones succeed in much of Africa and south Asia (e.g. Mishra *et al.* 1987, Panwar 1987, Karanth 1991, 1998) but in Indochina a corpus of trained and motivated personnel needs first to be generated (sect. 5.11).

Protected area core zones should not be compromised. No extractive use, no settlement, and no non-extractive use which impinges negatively on wildlife communities should be permitted. If existing non-core forest protection zones do not cater fully for human needs of forest, they should expand, not at the cost of the core zone, but into unprotected areas.

The National Biodiversity Conservation Areas of Lao are landscape-level protected areas within which core zones will be designated (sect. 3.1.6). It is urgent that this is done.

The large inviolate core zones needed for the focal species will probably need indefinite external funding: Alpert (1996) found no evidence that any ICDPs reviewed were viable in the absence of outside funding. True subscription to the ICDP paradigm necessitates understanding that large, inviolate core zones are integral to maintaining wildlife interest and that, therefore, for development to be integrated successfully with conservation, their management needs to be addressed.

Proximity to villages may hobble core zones. As the socio-economic setting and existing personnel are not conducive to anti-poaching work (sect. 5.11), voluntary, incentive-driven, re-settlement should be considered (K. U. Karanth *in litt.* 1998), noting the discussion in Saberwal (1997) and Karanth and Madhusudan (1997). However, past community re-settlements in Indochina indicate that very careful design is needed for them not to cause more, and new, problems, and on balance human re-settlement is best avoided if at all possible. Some issues meaning that most translocations are likely to have negative effects on focal species populations are:

- Resettlement programmes seem almost invariably to be under-funded, poorly

designed and at least partially coercive, and thus they disrupt stability without fully achieving their goal.

- Any disruption in human settlement discourages long-term resource management, both at the site of departure and at the site of arrival; 'use it before you go' and 'get in quick, before anybody else' mentalities may come to the fore.
- Removing one set of people may merely allow another set to come in; this problem is particularly pertinent for wildlife related re-settlements. People cannot move into an area evacuated to allow a reservoir to flood; they can to a conservation area. Newcomers are likely to make greater impacts on the biodiversity interest of an area than did the existing communities.

For these reasons any re-settlement suggested for wildlife-related reasons must be considered very carefully. This report cannot discuss the issue to the extent necessary. There have been some re-settlements already and their number is likely to increase. Full study should be made of past schemes should any future one be seriously contemplated for conservation-related reasons.

5.10.4 *Combatting poaching*

Conserving Tigers needs action against global criminal activities (which seek the focal species) and local rule-breakers (who poach Tiger prey). Combatting poaching within protected areas is a very high priority; indeed, anti-poaching foot patrols and intelligence networks are the key to giving protected areas a reality beyond paper designation (K. U. Karanth *in litt.* 1998). In India, success is highest where considerable effort builds up a local intelligence network and clear and specific anti-poaching plans are made (V. Menon *in litt.* 1998). Substantial resources are needed for this (Singh 1996), but even so, intelligence gathering is probably the most cost-effective way to reduce poaching (Menon *et al.* 1997).

Incentive systems rewarding protected area staff and members of the public who provide information leading to the arrest and conviction of poachers require specialist legal advice to minimise corruption.

Even broad grassroots support may achieve little in the face of a determined minority, so assertive preservationist tactics, particularly armed patrols with a mandate to detect and destroy all traps and deter poachers with force if appropriate, are necessary to protect the focal species, particularly in core zones. In Royal Chitwan National Park (Nepal), the 11 externally-subsidised anti-poaching units are central to project success (Dinerstein *et al.* in press).

Prevention is preferable to attempting subsequent detection and punishment, hence the importance of local intelligence. Post-poaching activities require the enthusiastic cooperation of local police and judicial systems; this cannot always be assumed (EIA 1996; Menon *et al.* 1997). Currently in Vietnam, the national Forest Protection Department is putting increasing pressure on the police to investigate various wildlife trade issues, some involving Tigers.

No research in Indochina has assessed the efficacy of various deterrents to poachers, but in Luangwa Valley (Zambia) frequent foot-patrols clearly reduced poaching; most staff in law enforcement units spent about half each month patrolling

in remote areas under difficult conditions. Full protection of vulnerable target species probably needs one guard per 20 sq. km of protected area (Leader-Williams *et al.* 1990). The ability to implement such policies in Indochina is limited, as there are not enough suitable staff (sect. 5.11); guard selection and motivation are key issues in successfully stemming poaching.

Residents around Nam Et National Biodiversity Conservation Area (Lao) reported to K. Khounboline (verbally 1998) that gaoling of some local elephant poachers deterred them from hunting elephants. Similarly, when fines were found to be a weak deterrent to commercial poachers in the Luangwa Valley (they could be paid by middle-men or the sale of valuable trophies), Zambian law was changed to give offenders a mandatory 5-15 years prison sentence (Leader-Williams *et al.* 1990).

Cross-border poaching occurs widely; in particular, many Vietnamese enter Lao and Cambodia to hunt and gather wildlife products, including the focal species. Hunters from Lao and Cambodia are less likely to go into Vietnam, as they come from a country with a much lower human population density and rather less depleted wildlife populations. The true magnitude of cross-border poaching is unclear as local people often shift blame onto outsiders, particularly foreigners, but it is unquestionably very high.

The detailed recommendations in Menon *et al.* (1997) for anti-elephant poaching activity in India should be studied and shaped for use in Indochina and similar plans produced to guide activity here.

5.10.5 Possible partners in management

Collaboration with bodies already possessing skills appropriate to reserve management should be encouraged. The Thai Border Patrol Police are trained in weapon use, combat tactics and working with villagers, three skills essential for protecting high-value quarry species (A. J. Lynam *in litt.* 1998). Protected area staff are rarely well trained in these activities, especially not the first two. The Vietnamese army is stationed in many reserves holding the focal species (e.g. Chu Mom Ray Nature Reserve, Yok Don National Park, Bu Gia Map Nature Reserve), because they are on the international border. Army personnel encountered on some recent surveys (in Yok Don and Chu Mom Ray, Vietnam, and at Dak Dam border post, Cambodia) had some knowledge and interest in wildlife; possibilities should be explored for capitalising on this to protect wildlife both in and out of protected areas. There may be possible conflicts of interest, in that armed staff stationed in remote areas may be involved in hunting for both subsistence and trade, which need to be addressed.

5.11 Need for strengthening region-wide protected area staff motivation and capability

Protected area staff are engaged in a relatively new undertaking for the region and not surprisingly many lack understanding of their role and the long-term goals of their work. A nebulous feeling of self-importance will not motivate them to work, let alone to take the risks necessary to protect focal species against poachers.

Provision of field equipment and budgeting for consumables (e.g. petrol for motor-cycles) is inadequate, at least locally. Such a concrete sign of neglect is likely to stifle all but a tiny number of staff.

Where protected area staff managers have long-term one-to-one relationships with advisors, staff output as a whole has increased concomitantly with the understanding by the manager of his role (J. Parr, K. Berkmüller, Venevongphet, R. Eve verbally 1998). Building capacity this way is labour intensive and vulnerable to staff re-organisation, but results in deeper, longer lasting, results than shipping staff off in bulk to short-term workshops and courses. Many protected areas in Lao and some in Vietnam are supported by bilateral aid programmes. Well selected external advisors to these give the best chance of forming capable, committed protected area managers and staff.

The social standing of protected area staff should be enhanced. In Indochina it seems relatively low (although we traced no structured research on this), in contrast to India where forest rangers and park guards have locally "powerful, socially coveted positions" (Karanth and Madhusudan 1997). People in positions perceived as such are likely to be of higher calibre and work nearer to their full potential, than are people who feel sidelined into protected area work rather than the more economically productive forestry sector. The level of, and reasons for, perception of low social standing should be researched so that appropriate counter-measures can be taken. Low payment seems a key factor (Lic Vuthy verbally 1997) and as in India (Singh 1996, Menon *et al.* 1997), the absence of protected area staff welfare schemes should be addressed. Improvement in field conditions and provision of incentives for special anti-poaching activities may also be important (Menon *et al.* 1997).

Study tours demonstrating conservation of the focal species should visit protected areas where species with high international value persist in the face of massive poaching pressure. This necessitates trips outside the region, perhaps to India (see, e.g. Johnsingh and Goyal 1995) or Nepal, where rhinoceroses remain only because of the commitment of park guards and their acceptance of the danger inherent in combatting poaching. Maintaining the focal species in Indochina will need this sort of personnel (sect. 5.10.4).

Selection of protected area staff needs care, and needs to be on a location-specific basis. Local people will know the area better, and thus be better able to manage it, but they will also know the people better. While it may be difficult for people to apprehend members of their own community (see also sect. 6.2.2), solid long-term success is more likely when regulators come from within a community than from outside. This re-emphasises the need for massively improved awareness among both staff and adjacent communities about the aims and practicalities of protected areas.

PART 6: RECOMMENDATIONS FOR ADDRESSING POLICY ISSUES

6.1 Hunting

High hunting levels threaten focal species populations and are considered under "Maintenance of ungulate prey base for big cats" and "International trade". Understanding this division is central to focal species conservation, as different groups of people are involved and therefore different strategies are needed to tackle the problem. Furthermore, success with one group alone will not preserve the focal species.

6.2 Maintenance of ungulate prey base for big cats

6.2.1 The critical role of the prey base

Tiger densities are linked to those of their prey (Schaller 1967, Sunquist 1981, Seidensticker and McDougal 1993, Karanth 1995, Karanth and Sunquist 1995, Miquelle *et al.* 1996), which have been overhunted in much of Asia (Karanth 1991, Rabinowitz 1993, Miquelle *et al.* 1996). Direct poaching and habitat modification stress Tiger populations, but computer modelling suggests that low prey levels primarily drive the decline of Tigers (Karanth and Stith in press). This is very likely to be true for Indochina; all who have surveyed in the region agree that ungulate populations are well below carrying capacity.

Hunting throughout tropical forests globally is lowering populations of quarry species; if unchecked, it could cause their eventual extinction over large areas (Kramer *et al.* 1997, Robinson and Bennett in press). Effects are strong in Asia compared with much of Africa and Latin America, due to higher human population densities, better technologies and greater market connectivity (Karanth 1998); Indochina is extreme even within Asia due to the abundance of arms from past and ongoing conflicts, past government attitudes to conservation, decades of unrestrained hunting, proximity to a major market for wildlife products (China) and various other factors.

A fundamental action priority for Tigers is therefore to recreate healthy ungulate populations. Tiger densities for India (see Karanth 1995), where prey such as deer remain abundant, indicate that the large conservation areas of Indochina could support major Tiger populations, if ungulate prey returned to natural densities.

Such Tiger populations would tolerate poaching better than do the current relics in Indochina (see Karanth and Stith in press; also, for Puma, Lindzey *et al.* 1992, 1994) and would probably be less likely to take domestic animals. Jaguars *Panthera onca* with sufficient natural prey rarely take livestock (Weber and Rabinowitz 1996). If

specific Tigers causing problems (often those injured in previous encounters with people) are eliminated and common sense is applied to husbandry (sect. 6.3.4), Tigers and people can perhaps occupy adjacent areas. It is unlikely that true co-existence will ever be possible in Asia (K. U. Karanth *in litt.* 1998), but rebuilding ungulate populations will reduce the tendency for Tigers to roam long distances looking for prey, including, inevitably, domestic animals.

Re-establishment of regional ungulate populations will involve several activities, particularly:

- Restraining gun use;
- Prohibition of snares and other non-selective traps for ungulates;
- Restricting sale of wildlife meat in markets and restaurants.

6.2.2 *Firearm restriction*

Ten years ago, gun use in Vietnam was almost unrestricted (Ratajszczack 1988), but since the early 1990s the country has vigorously restricted civilian use of guns. While the effectiveness of Vietnam's policy has not been quantified, crude comparisons between Dak Lak Province (Vietnam) and Lao (most notably in muntjac sighting rate) suggest that quarry species have benefitted (Le Xuan Canh *et al.* 1997b, Timmins *et al.* 1998). Weiler (1998a) pointed out that as few Tigers are shot in Cambodia (most are snared, trapped, poisoned or blown up with baited explosives), gun control will have little impact on Tiger poaching directly. The main benefit will come indirectly, through the higher population levels of prey species.

In an ongoing programme for rural civilians to hand guns to the government (voluntarily at first) in Lao, all ethnic groups should participate; at Phou Khaokhoay National Biodiversity Conservation Area, lowland Lao surrendered guns relatively smoothly, but little progress has thus far been made with the Hmong (J. Parr verbally 1998). The latter are the very people who hunt the most.

Yunnan Province is also currently tackling widespread gun use (e.g. in late 1996 seven men with guns were met in one day in the Xishuangbanna National Nature Reserve; Yu Changqing *in litt.* 1998). In 1991, there was no shortage of home-made guns (Santiapillai 1991a). Most people cannot now legally carry guns. Local police were poor at confiscation because, knowing the offenders, they felt inhibited from disciplining them. Responsibility was transferred to the military, who usually had fewer social ties with villagers. Many guns remain in circulation but the campaign is having a noticeable effect (Wang Yingxiang and Jiang Wang Gao verbally 1998).

Firearm use remains high in rural Cambodia. As long as social unrest persists, cessation of ownership and use by civilians is unlikely. However, notable progress with a gun buy-back initiative is being made at least in and around Virachey National Park. As in Lao, co-operation is higher if the policy applies uniformly to all people (Weiler 1998a).

6.2.3 *Trapping*

Ungulates are also threatened by widespread snaring; in at least Vietnam, snares strong enough to catch wild cattle are set (Le Xuan Canh verbally 1997), although

these are used rarely if at all in Lao (S. Sawathvong verbally 1998). A description of a snare sufficient to catch an adult Tiger is given in Weiler (1998b). Recently in the Huong Thuy District of Thua Thien-Hue Province, Vietnam, 1100 snares were found in 400 sq. km; in nearby Phong Dien District, 140 snares baited for carnivores were found in Phong Mi Commune. In these snares, a pliant living branch pulled down from a tree-crown provides the tension to pull into the air any carnivore coming to the bait. Recent captures included Tiger and Asiatic Black Bear *Ursus thibetanus* (Nguyen Diep Hoa verbally 1998).

Snares are particularly damaging because of their non-selective nature (e.g. Noss in press). Tiger prey would benefit from cessation of use of snares and other non-selective traps; initial emphasis should be given to protected areas. After the gun campaign (sect. 6.2.2), Government of Lao envisages tackling the snare issue. Rural resistance is likely to be stronger as snares are less energy intensive (they have very low management and time costs; Noss 1997) and are seen as more traditional (S. Sawathvong verbally 1998). Snaring is also a major issue in Cambodia; deer and pigs in snares are "often" eaten by Tigers, which, if caught doing so, are shot; and Tigers themselves are caught "often" in game snares (Heng Kimchhay *et al.* 1998). The issue is already being addressed in Vietnam, in certain high priority areas, for example the Thua Thien-Hue Forest Protection Department is first collecting snares in areas important for Saola (Nguyen Diep Hoa verbally 1998). A major motivation to do this is the danger that the snares pose to people, in this case the forest guards who are conducting surveys and patrolling the area.

6.2.4 Wildlife meat consumption

In an ongoing government initiative in Lao to control sale of wildlife meat in urban restaurants, some districts have already lowered trading levels considerably, primarily by sending patrols to check regularly on restaurant menus. Stricter patrolling and punishment are needed with expansion of action throughout the country (S. Sawathvong verbally 1998).

It is unclear if wildlife meat sale should be terminated; the ability to eat it may stimulate urban people to wish to retain wildlife and its habitat. Pragmatic reasons for habitat retention (e.g. catchment protection) rarely extend self-evidently to the inhabiting wildlife. Legal exploitation of wildlife would require quotas, best based upon known population densities: these are not available. In the interim, adaptive management (see Policansky 1986) could serve if off-take quotas could be guided with short-term flexibility by rigorous monitoring of wild populations. Preventing corruption in interpretation of quotas might prove difficult.

6.2.5 Concluding remarks

Retaining good ungulate prey populations is in everybody's interests: they serve local communities as well as Tigers. Successful innovative initiatives to promote sustainable use should be tailored to regional circumstances for successful implementation over large areas of Indochina. The experimentation necessary should not take place in areas important for Tigers, where traditional core zone management should be implemented (sect. 5.10.3). In the absence of an adequate prey base,

curbing international trade in Tigers will be in vain.

6.3 Resolution of human-wild animal conflict

6.3.1 Background

All the focal species can kill people and / or damage farmed animals and plants. Conflict is apparent even with wild cattle, which (e.g. in Louang-Namtha Province, Lao) are perceived by villagers as in grazing competition with their domestic stock (S. Sawathvong verbally 1998). Such conflict may erode local support for conservation, and the enthusiasm of politicians and conservation authorities. Problem animals may label an entire species, and the protected areas harbouring it, as problematical (Tilson and Nyhaus 1998), such that now farmers may be the main killers of Sumatran Tigers (Plowden and Bowles 1997). During 1996-1998 in India, poisoned Tigers were found with no parts removed, indicating that they were not killed for trade, but poisoned by angry villagers (Anon. 1998). Farmers are significant killers of Tigers in Indochina too (Annex 1).

Resolving existing problem situations is therefore a high priority. Preventing further incidents is better than rectifying them by means such as compensation payments. The latter divert money from more constructive activities, invite corruption and provide negative publicity for conservation (Linnell *et al.* 1997 and references therein, Saberwal 1997).

Problems caused by wild cattle are negligible compared with those by Tigers and Asian Elephants, so discussion focuses on these latter two.

6.3.2 Scale of the problem

The magnitude of the conflict problem is unclear. No co-ordinated research has assessed levels, and furthermore claims of conflict may be used as a pretext for killing animals for profit through trade. In Vietnam, "every year virtually every province with a healthy population of Tigers will tell you that villagers killed a Tiger that was preying on livestock but that the bones and skin were sold and they don't know where it went...except to the marketplace" (E. Kemf *in litt.* 1998).

The Yunnan Forestry Bureau pays approximately 2 million Yuan (about US\$ 180,000) per year compensating damage by wild mammals (Wang Weimin verbally 1998). Elephants there cause substantial agricultural loss, estimated in 1991 as 540-56,000 kg per year (Santiapillai 1991a); the annual compensation outlay for elephants alone comes to several hundred thousand yuan.

Bergmans (1995) reported that people of Dakchung District (Xekong Province, Lao) asked the national authorities "a hundred" times per year to deal with problem Tigers, and that in 7-8 cases permission is granted to kill the Tiger. These figures are grossly inflated, even allowing for repeat requests (C. Inthavong verbally 1998). Bergmans's informant may have exaggerated, or understanding may have broken down between informant, interpreter and author (see Duckworth 1997). An estimate of 250 cattle lost per year given in the same area in late 1997 is so equally clearly exaggerated that it casts doubt on more plausible estimates (Showler *et al.* 1998a).

In fact, only 2-3 requests concerning problem Tigers reach CPAWM (the competent Lao government body) most years from Dakchung, and only about 10 from the whole country; other areas providing repeated requests are Louang-Namtha Province and the Nam Ha NBCA area (C. Inthavong verbally 1998). Annual requests to deal with problem elephants also number about 2-3, often from Phou Phanang National Biodiversity Conservation Area, and Phongsali and Louang-Namtha Provinces (C. Inthavong verbally 1998).

Stock-killing by Tigers was not widely cited as a major problem during a wide-ranging interview survey in Cambodia. Attacks on humans seem far more frequent, especially in Koh Kong and Pursat Provinces; some happenings may be exaggerated, e.g. a 50-strong series of killings (Heng Kimchhay *et al.* 1998).

6.3.3 *The need for set policy and rapid action*

Formation of a systematic process for dealing with problems is an urgent need. Indochina is not alone in this: Tilson and Nyhaus (1998) found no Tiger range state with proactive policies for problem Tigers. These authors recommend the formation of specific rescue teams for Tiger conflict issues. The scale of work in the region is such that these teams should have the mandate to tackle elephant-related problems as well.

Dilatory official responses exacerbate problems. Even in India, there are still problematical delays in responding and providing compensation (Anon. 1998). In several incidents in Lao where villagers' requests to address problems stimulated no action, people took matters into their own hands (e.g. Tizard *et al.* 1997). In parts of Nghe An Province, home to northern Vietnam's most important Asian Elephant population, "killing [elephants] has become recognised as an acceptable method of conflict mitigation and prevention", in the absence of official policy or action (Walston *et al.* 1996).

In Yunnan Province it may take over two years to deal with a problem Tiger through official channels, as the government must be convinced the claim is genuine, and permission to kill can only be granted by the Minister of Forests himself in Beijing. Payments are made for stock lost to Tigers, but not to Leopards; getting proof of a genuine Tiger delays payment. Paying compensation for elephant damage may take several months; part is paid by central (Beijing) and part by province (Kunming) government. The money comes from general taxes and the Nature Reserve staff are authorised to make payments (Wang Yingxiang verbally 1998).

In all countries, local authorities should respond swiftly to requests, using the appropriate central body to resolve the situation. The decision to kill problem animal(s) should be made officially, not in unilateral rural action.

Rapid response is difficult in Lao: there is yet no formal policy for whether loss should be compensated, whether problem animals should be killed, who should kill animals, or funding sources (C. Inthavong verbally 1998). Vietnam has no national compensation scheme nor any formal recording process to enable accurate assessment of conflict levels (Dawson 1996) nor does Cambodia (Lic Vuthy verbally 1997). It is not surprising that local people use their own means to deal with problem animals, ranging from labour-intensive methods (e.g. permanent defence of

vulnerable crops) through the prosaic though effective shooting of individuals to more imaginative solutions such as baiting anti-personnel mines for Tigers.

A problem Tiger at Ban San Dtur, Lao, was shot with permission of the district authorities. The marksman received 900,000 kip (then about USD 600) from the district authorities, who the community believe resold the bones and skin to Vietnamese traders for 1.3-1.5 million kip. Villagers felt aggrieved that those losing stock were not compensated, but that one individual received so much money (T. Hansel *in litt.* 1998). Clear policy should state where money paid by the government will go and ensure equitable distribution.

Compensation made should reflect the market value of stock killed or crops despoiled; however, this is difficult (Nath and Sukumar 1998). In India, under a new initiative, funds from WWF India for rapid response will be lodged with local NGOs, and the delay in claiming from the government will thus not be borne by the farmers. Furthermore, WWF's Tiger Conservation Programme will bear any losses. Incentive money will be paid to villagers for early reports, and where poisoning of the Tiger on return to the kill seems a possibility, a guard could be hired for the period prior to the Tiger's return (Anon. 1998). Formulating a response strategy for Indochina should examine the success of this Indian initiative and consider whether such features, appropriately modified, should be used.

6.3.4 *Issues specific to Tiger*

Measures to reduce stock loss to Tigers should be widely employed, including relocation of stock to lower risk areas (this has been successful in Xishuangbanna) and corralling domestic animals at night. Farmers the world over may resist adopting new herd guard practices, as it involves extra work (P. Jackson *in litt.* 1998); appropriate starting incentives may be worthwhile. High levels of conflict result from low prey numbers (from overhunting; sect. 6.2) combined with expanding human populations placing stock in areas until recently forested. Unless these basic issues are resolved, preventing stock loss will remain exceedingly difficult.

Problems and possible solutions of Tiger-human conflict are discussed in Nowell and Jackson (1996); work on Jaguar in Quigley and Crawshaw (1992) and Rabinowitz (1995a) is also relevant. Attacks on humans are so infrequent over most of the region that only in isolated instances will the issue need to be addressed; wearing human-face masks on the back of the head has been successful in reducing casualties elsewhere, e.g. the Sundarbans, Bangladesh / India (Nowell and Jackson 1996) but has not been tried yet in Indochina.

Large areas with no farming and thus no conflict are needed to support Tigers (sect. 5.10.3). Karanth and Madhusudan (1997) "know of no site in Asia where high density, productive Tiger populations coexist with high density human populations depending on agriculture, forest product extraction, and animal husbandry without the need for very significant regulation over human activities".

6.3.5 *Issues specific to Asian Elephant*

Bull Asian Elephants feed in farmland even where natural resources abound, because crops are highly nutritious. Males risk crop raiding to increase success in

intrasexual competition (Sukumar and Gadgil 1988). Females and their herds usually damage crops persistently only where natural resources are insufficient: e.g. where forest is encroached so fast that resources available to elephants decline faster than the animals themselves.

Thus, even around large tracts of good natural elephant habitat, repeated crop damage may occur. Raiding in African Elephants *Loxodonta africana* may be taught by example from a few old bulls to younger ones (Osborn and Rasmussen 1995). If this is also true for Asian Elephants, then individual elephants involved in each problem area need identification and targeting in deterrent action.

Shooting at Asian Elephants in crop fields is dangerous; it often takes 5-10 shots to kill the animal and the elephant may become enraged and try to attack people. Fields have few hiding places, so people prefer to re-find the elephants in the forest and kill them there (K. Khounbolin verbally 1998). There is obvious potential for the wrong elephants to be shot.

Final resolution in problem black-spots is difficult, but there are currently some innovative plans. The proposed conversion of the Tan Phu Forest Enterprise, Dong Nai Province, Vietnam into an elephant sanctuary has full local and government support (Pham Mong Giao *et al.* 1997; J. L. Walston verbally 1998). It will involve retraining and employment of the enterprise staff as wildlife guards (although currently superfluous after the last felling cycle, they remain on the province's payroll), the conservation of wildlife over 140 sq. km, and making elephants' needs prominent when resolving conflicts. Tourism / recreation will generate some income, but external funding will be necessary. Redesignating the area's function will not change elephant behaviour, but it does allow management priority towards elephants and conflict resolution. Indeed, the area should expressly be a testing ground for this.

The Sangthong District and Phou Phanang National Biodiversity Conservation Area (Lao), an area retaining important elephant numbers, includes the Vientiane Forestry College field site for research and education, and should be a similar experimental area.

The essential reference on elephant-human conflict is Osborn and Welford (1997) which contains an authoritative yet accessible discussion and a lengthy reference list to other studies (this source was unfortunately received too late for incorporation into the present text). Other useful sources from outside the region for background information on elephant-human conflict include Blair *et al.* (1979), Seidensticker (1984), Sukumar (1989, 1990, 1991), Thouless (1994), Balasubramanian *et al.* (1995), Datye and Bhagwat (1995), Thouless and Sakwa (1995), Lahm (1996), Fernando (1997) and Williams and Johnsingh (1997). The in-depth study of Nath and Sukumar (1998) was also received too late for incorporation into this text.

Electric fencing

Thouless and Sakwa (1995) reviewed the success of various electric fence types against elephants in Kenya. The results provide guidance for Indochina but may not be directly applicable: ivory is a good insulator and many fewer Asian Elephants have tusks than do African Elephants, suggesting that fences might be more effective in Asia. However, the wetter soil of South-East Asia conducts electricity better than



FAUNA & FLORA
International

Conserving wildlife since 1903

**Human/Elephant Conflict in Dong Nai Province
- An Urgent Appeal -**

On November 1st in Dong Nai province, southern Vietnam, a herd of Asian elephants raided two villages, killing two local people. Additionally, extensive areas of agriculture and a number of houses were destroyed causing widespread loss of infrastructure and income. This loss of livelihood is seriously affecting the quality of life of subsistence farmers and their communities. The situation now dictates that, if nothing is done immediately to mitigate this conflict, more human and elephants lives will be lost.

This incident brings to a head the on-going conflict between this herd of elephants and local communities which has resulted in the deaths of forty people and thirteen elephants. Over the years, the elephants' natural habitat and food sources have steadily been destroyed, initially by logging and resource extraction, and later by clearance for agriculture. The local population relies almost entirely on agriculture for subsistence and income and has little alternative but to defend its crops and communities.

While the conflict has continued for almost ten years, for much of this time the problem has been restricted to crop-raiding. With the recent escalation of destruction and the deaths of local people, the government of Vietnam has decided to act. It has charged the Ministry of Agriculture and Rural Development (MARD) with producing a set of immediate proposals for mitigation of the conflict; these should protect the species -- which is in imminent danger of extinction in Vietnam -- and protect the local people from loss of life and livelihood.

In 1995, Fauna & Flora International (FFI) was invited to implement the government's Elephant Action Plan. The Ministry has therefore formally requested assistance from FFI to send an emergency field team to assess the situation and to develop suitable recommendations for the government.

A significant part of the problem is socioeconomic, and consequently the Dong Nai situation will be a test case for other areas of conflict in Vietnam. For this reason the field team will include an expert in rural human development. It will also comprise a single representative from each of the three major government agencies involved with nature conservation, ecological resources and rural planning, all of which come under MARD.

In order to achieve a deadline set by the government (after which time the elephants will all be shot) and to mitigate the on-going loss of livelihood, FFI intends to initiate the mission immediately. Consultation has begun, permissions are being secured and the team intend to leave for Dong Nai on the 10th December. The team aims to present the Ministry with an assessment of the situation and a set of recommendations for action no later than the 25th December.

All assistance with funding would be gratefully received and duly recognised in all outputs by Fauna & Flora International and the government of Vietnam.

Box 2: some cases of elephant-human conflict are extreme. FFI were successful in initiating a long term solution (sect. 6.3.5).

does the dry soil of Kenya, giving greater likelihood of damp posts earthing the wire (D. Duff *in litt.* 1998).

Thouless and Sakwa (1995) concluded that elephants can overcome each modification, meaning that a fence's effectiveness is not determined by design, construction and voltage. Rather than an expensive 'arms race' with crop-raiding elephants over fence features, efforts are better invested in active management of low-cost, low-technology fences, including vigorous treatment of fence-breaking elephants from the start, to instill recognition in the elephants that the fence demarcates a 'no-go' area.

Electric fences were set up in three villages within the Mengyang sub-reserve, Xishuangbanna National Nature Reserve, in 1991 (Santiapillai 1991a, 1991b, 1992) with the co-operation of local people (Su Jhieng Gue verbally 1998). Damage to crops indeed decreased, but the programme has now ceased (Yu Changqin *in litt.* 1998) as frequent maintenance was needed (e.g. cutting vegetation along the fence, servicing batteries), some elephants found places to crawl under the fence, and some learnt to destroy it, reportedly by hitting the wire with a branch held in the trunk (Wang Weimin verbally 1998, W. V. Bleisch *in litt.* 1998). The first two problems may be soluble by better siting and maintenance; the last requires removal of the problem individual(s). Results from Malaysia suggest that electric fencing is unlikely to be a "very realistic possibility in the Lao context" (C. W. Marsh *in litt.* 1998).

Trenches

Although Santiapillai (1997) considered trenches unreliable, as they seldom survive rainy seasons and suffer from "elephant arse erosion" (*sic*), in Nagarahole (India) when built to sufficient dimensions they survive rainy seasons in climates with 1500 mm of rain annually. A major additional advantage is that they keep cattle and land encroachers out (K. U. Karanth *in litt.* 1998). Experimentation with this method in Indochina should proceed, understanding that good trenches are expensive as success depends on the size of the initial construction; dimensions in the order of 3 m wide and 2 m deep are needed (Osborn and Welford 1997).

Canals

Deep sided canals are suitable only where a deterrent water level remains all year, as in hydropower headponds (to prevent elephants and other very large mammals crossing to islands in the drawdown zone). The strong seasonality of rain and therefore surface water in Indochina limits canal use in natural situations.

Crop planting issues

Crop damage can be reduced if areas frequented by elephants grow crops unpalatable to them such as tea or oilseed, rather than sugar-cane, rice, millet, rubber and other plants which they do eat. A barrier of distasteful crops, of at least 1 km width, should be grown around areas of tempting crops (Santiapillai 1997).

Sacrificial plantings for elephants in areas of recurrent conflict could deflect damage from villagers' fields. Judicious planting for problem Brent Geese *Branta branta* in the UK decreased loss in commercial fields. The following factors

maximise effectiveness (Vickery *et al.* 1994; G. Anderson *in litt.* 1998):

- scaring elephants vigorously off commercial fields but leaving them unmolested on the sacrificial crops;
- siting sacrificial fields in problem black-spots;
- growing highly nutritious cultivars for the wild animals; and
- co-ordinating activity throughout the range of problem herds or individuals.

Expenses could be partly defrayed by selling remaining crops and charging visitors to watch elephants, but outside financial support would be necessary. It is unclear whether this approach has ever been used with elephants; it is under consideration in India, but there is concern about how to ensure reliable local cooperation and appreciation of long-term benefits (A. Venkataraman *in litt.* 1998). For such a radical suggestion to be implemented in Indochina, a field study tour of an existing scheme (if not with elephants, then with geese) for key people from the pilot area is advisable.

Aversion therapy

On the Dakchung Plateau, Lao, villagers burn pots of chili pepper to create an irritating smoke to try to drive away elephants (Showler *et al.* 1998a). African Elephants are clearly discomfited by oleo-resin capsicum aerosol sprays and it is possible that by co-ordinating defence of vulnerable croplands and spraying elephants on every entry to the fields, the animals would associate crops with intense mucosal irritation in the trunk (and elsewhere), and desist from eating crops. The approach is labour intensive as the deterrent is sprayed manually at each potential crop-raiding incident (Osborn and Rasmussen 1995). Activity needs local co-ordination so that irritated elephants do not merely move to adjacent fields where they are not sprayed. Assessing the potential of this method with Asian Elephants in Indochina is a high priority; experimentation in Africa is ongoing and is co-ordinated by L. Osborn (37 Lewisham Avenue, Chisipite, Harare, Zimbabwe).

Translocation

No investigation of the potential of translocation to resolve conflicts in Indochina has been published, so the following discussion is based on a recent review from Sri Lanka (Fernando 1997). Translocation is appealing as the individuals remain in the wild gene-pool. Certain features enhance chances of successful translocation:

- a release site several hundred kilometers from the capture site, with no possible return route or with long-term blockage of such routes;
- removal of all elephants from the problem area;
- no other local wild elephants to move in to the problem area and fill the gap;
- very large release area remote from the types of crops grown in the area of origin;
- existing elephant density in the release area well below carrying capacity; and
- adequate protection from poachers (this is not stated for Sri Lanka but is highly relevant to Indochina).

Few, if any, sites fulfil these criteria in Sri Lanka; most conservation areas there hold elephants at close to natural density. Thus, resettled elephants often wander, and may in the process find and consume crops, thereby translocating the problem with the elephants: there is no net gain.

In Cambodia and Lao very large areas are remote from significant cultivation, and across Indochina, there are many areas of suitable habitat from which all elephants have been poached; however, until quashed, this very poaching makes these sites unsuitable as release areas.

Any suggested translocation in Indochina needs careful consideration by people familiar with the region and others, necessarily from outside, experienced with translocation. The only recent attempt in Indochina for which results were traced was disastrous: in early 1993, at least 15 elephants were caught in southern Vietnam: four adults died, six young were tamed and five were held in indefinite limbo pending decision whether to export them to Singapore or release them in a Vietnamese protected area. One person was killed (Santiapillai 1993b). Translocation needs experienced personnel. During operations in India, despite highly skilled personnel, many animals die (A. Venkataraman *in litt.* 1998). Teams (not just leaders) from outside Indochina would be needed (and selected carefully: the 1993 team in Vietnam was reportedly largely Thai), should translocation be attempted; building up in-country capacity on the remote chance of future use is not a priority.

Elephants must be moved by vehicle; tamed elephants cannot drag them far enough (A. Venkataraman *in litt.* 1998).

After such an operation, monitoring for several subsequent years is essential to evaluate success and refine techniques for later translocations: Fernando's (1997) assessment of options in Sri Lanka was hindered by the lack of follow-up studies.

6.3.6 *Liaison with land-use projects*

Seidensticker's (1984) clear guidelines to help land-use projects minimise conflict with elephants also help with Tigers. Project design should:

- consider elephant needs and try to forestall conflict;
- facilitate elephant access to existing critical resources or to alternatives provided;
- hamper their access to sensitive areas and create appropriate buffer zones;
- not pocket elephants in small or unsuitable areas;
- stimulate strong local support at all levels for elephants;
- fully involve local wildlife authorities; and
- provide external expertise and funding if appropriate.

In particular, ICDPs (sect 5.10.1) should not promote developments likely to foment human-wildlife conflict (see also sect. 6.4), and "environmentally-friendly" forestry projects (mooted in areas important for the focal species such as Kon Plong District, Vietnam, and Sangthong District, Lao) can only describe themselves thus if they maintain wildlife populations, including the focal species, in their areas.

6.3.7 Individual problem animals

However conflict with these species is reduced, individual problem animals are likely to occur.

Thouless and Sakwa (1995) recommended shooting fence-breaking African Elephants. While the population even of the more threatened Asian species could sustain loss of certain problematical bulls, the cultural position of elephants makes culling objectionable to many people (Sukumar 1991). In India single rogue bulls are often tamed, particularly where capture technology is good and translocation is not possible (V. Menon *in litt.* 1998).

Translocating problem Tigers is unlikely to succeed: large carnivores may return hundreds of kilometers to their home range, may cause damage at their release point or while wandering, and survival and breeding success of translocated animals are low (Linnell *et al.* 1997). Linnell *et al.* concluded that expensive translocations with limited success waste conservation resources, except in exceptional circumstances: none pertains to Indochina today. Thus, "where unavoidable conflicts occur wildlife managers will have to educate the public ... that lethal control is ... unavoidable".

Identification of the individual problem animal can be very difficult (P. Jackson *in litt.* 1998), but even so expensive and / or unpopular activities should be undertaken only once identification is certain.

6.4 Major land-use projects

Even in Lao National Biodiversity Conservation Areas, sufficient area cannot be declared protected to cover all individuals of the focal species. All major development projects should consider their needs, particularly of elephants, away from protected areas.

Major projects liable to increase human population or access to areas important for the focal species are entirely inappropriate within or adjacent to declared protected areas; if given government sanction they call into question the institutional commitment to nature conservation (sect. 6.8.3). For example, Lam Dong Province, Vietnam, has reportedly initiated economic development in Village 5 of Tien Hoang Commune. The nearly 200 households in this village are within Cat Loc Nature Reserve, a reserve of outstanding global importance, most notably for one of only two surviving populations of Javan Rhinoceros. Introducing commercial cashew-growing, which might be argued to decrease pressure on natural resources through increasing local living standards, has done the opposite: local people are busy clearing forest for further cashew plantation (see sect. 5.10.1). Such failure to co-ordinate land-use in and around protected areas can render any site-specific work for the focal species still-born.

Construction or re-settlement projects in all areas containing populations of the focal species should legally require independent Environmental Impact Assessment study prior to project design. This is not just to meet conservation needs of large mammals: careful siting of new projects directly benefits developments themselves by lowering chances of costly conflict (sect. 6.3). Particular care is needed with:

- routes of seasonal movement; and
- critical habitat features (e.g. saltlicks and waterholes).

None of the countries has an adequate assessment process. In Lao a bill is being drafted by the Science, Technology and Environment Organisation of the Prime Minister's Office to give a firm legal basis for Environmental Impact Assessment procedures (Venevongphet verbally 1998), and the Ministry of Environment in Cambodia will shortly begin work on a bill (C. Poole *in litt.* 1998). Such a law has been in force in Vietnam since 1994 (Ngoc Duc Manh 1994).

Attention to local attitudes is necessary; villagers around the Nam Theun 2 hydroelectric power project (Lao), fear that dam construction will force local elephants closer to villages. They thus hope that the elephants will be 'sent to Vietnam' (K. Khounbolin verbally 1998). This would obviously be impracticable and entirely unsatisfactory given the greater pressures on land in Vietnam and the poor elephant conservation record (sect. 3.1.2).

Hydropower projects need especially careful consideration as they may:

- block movement routes;
- facilitate access to previously remote forest areas;
- cause a general influx of people to the area; and
- produce, in headpond drawdown zones, attractive feeding for elephants and wild cattle, which then risk entrapment on islands (by rising water as the rainy season starts) and heavy hunting (areas are easily accessible).

Hydropower projects should therefore block access for large mammals to seasonal islands and fund effective anti-poaching measures (sect. 5.10.4) within their environmental mitigation programme.

There is much grey literature on the possible effects of hydropower projects in the region (e.g. WCS 1995b-e, 1996b), but few case studies of existing projects anywhere in South-East Asia; UKM (1990) is a notable exception. Understanding how hydropower projects may affect the focal species is important, as many are proposed for Lao (Usher 1996), often within National Biodiversity Conservation Areas (Berkmüller 1995). Insights should be gained by studying the focal species around existing schemes in the region and elsewhere (see also Duckworth *et al.* 1998).

6.5 International trade

The people behind the killing and trading of the focal species are not generally marginalised subsistence people, in need of sympathetic help to adopt a less destructive lifestyle. They are hardened criminals exploiting gaps in administrative commitment and weak law enforcement. Interpol considers that wildlife constitutes the second-largest illegal trade in the world. Low detection risk and massive profits attract international smugglers to wildlife. Illegal trade survives by diversifying routes, contacts and commodities. There is little information on the individuals

involved in Indochina, but in India, some illegal wildlife traders are also involved in narcotics, links are strong with arms dealing and key figures often have strong political connexions (EIA 1996, Menon *et al.* 1997). As Kumar and Wright (in press) state: "wildlife traders are city-based, Mafia-style gangsters, such as those in drug-running cartels. They are the money-men at the heart of the trade".

Enforcement and legislation should target the real malefactors. Setting priorities and formulating policies needs clear distinction between poachers and traders (Kumar and Wright in press). Punishing the villager who fired the gun or set the snare will not change trade levels; to those running the business, such villagers are dispensable. There is increasing recognition of this need, e.g. in a recent case in Thua Thien-Hue province police are focusing more on the trade ring rather than the taxi-driver found with a live Tiger and a live bear in his car (D. Hulse verbally 1998).

Action for conserving elephants, Tigers and wild cattle thus differs from that for species of low international value. Banning civilian gun use in Vietnam allows muntjacs to persist, at least locally (sect. 6.2.2); it has not maintained populations of elephants and Tigers.

Important components in conservation programmes for mammals hunted mainly for local markets or home consumption (e.g. muntjacs and civets) include public education, careful linkage of local development with conservation goals, protective legislation for the species and local consultative agreements. These measures, promoting conservation through its long term community benefits, are unlikely to cut ice with those driving and controlling hunting of the focal species.

Trade in the focal species can be curbed by vigorous enforcement of realistic laws with penalties severe enough to deter would-be offenders, but ultimate control is unlikely, and vigilance can never be relaxed, so long as lucrative markets exist for ivory, wild cattle trophies, Tiger bones etc. Eradicating the market, the surest way to prevent trade, is a great challenge, as parts of dead elephants and Tigers in Asia have been widely used for generations. Removal of all Tiger parts from the Chinese National Medicine Directory (the official pharmacopoeia of practitioners of traditional medicine in China) is a major step; pharmaceutical use of Tiger bone and products is now illegal there (Mainka 1997: 24-26). There are indications from India that some ivory carvers would move readily to alternative media, including some involving minimal conservation problems, e.g. soapstone and camel bone (Menon *et al.* 1997).

The international Thai market for wild cattle trophies may have arisen through the interplay of depleted Thai wild cattle populations and increasing affluence. Srikosamatara *et al.* (1992) found that "trophy owners gave no particular value to wildlife and trophy collection is just another form of status decoration. In many cases, the trophy advertises the owner's wealth as only wealthy people can afford such decorations".

However, at least in Lao the main factor driving wild cattle poaching is medicinal: parts (gall bladder, bile and bladder) are used domestically and exported to China and Vietnam. Horns are merely a lucrative by-product. Protecting cattle stocks by tackling the trophy market may thus have little effect if medicinal issues are not also targeted (C. Inthavong *in litt.* 1998, Venevongphet, K. Khounbolin, S. Sawathvong

The Tiger who couldn't go home

Reports about Tigers being trapped or killed by hunters are not uncommon in Vietnam, with several reported annually. However, the plight of a young female cub caught in July 1998 in the central province of Thua Thien-Hue was exceptional. Wildlife traders who had purchased the cub along with a 70 kg Asian Black Bear were transporting the two valuable animals to Hue in the boot (trunk) of a taxi cab. Fortunately, attentive forest guards from Phong Dien District noticed the taxi and became suspicious, wondering why anyone would call a taxi to that remote forest more than 50 km from Hue, Vietnam's former imperial capital.

After questioning the taxi driver and the traders, the guards found the young Tiger and bear squeezed in the tiny boot. Both animals have been stuffed into small wire cages normally used to transport pigs, an indignity for such marvelous wild creatures. Unfortunately, due to severe mistreatment by the traders, the bear died shortly after it was found.

The Tiger however proved strong and resilient. She was kept for several weeks by the Forest Protection Department in Hue where the staff tended to the wounds on her front legs, caused by the steel trap used by hunters to capture her. Guidance was provided by staff from the Hanoi Zoo, including tips on diet and medicine.

During the recuperation process, the FPD staff were busy collaborating with the police to bring the wildlife traders to justice. Although the taxi driver was released, and the local hunters are in hiding, the police hope to use this case to break the trade ring stripping out the wildlife from the central provinces of Vietnam. The investigation is ongoing.

After consulting with Tiger experts, it quickly became clear that releasing the young female cub back to the forest could prove dangerous. Probably too young to survive on her own, it is fairly certain that even if she were to be reunited with her mother, the young cub would be rejected because of her close contact with humans. Even if she could manage to survive alone, it is feared that she might become dangerous to humans, considering the trauma she has experienced. With some reluctance and sadness, Hoang Ngoc Khanh, Director of the Hue FPD, agreed that the young Tiger would have to spend the rest of her life in captivity.

When she was transferred to the Hanoi Zoo, the young cub gained notoriety as the "Tiger who could not go home". A press conference was held at the zoo by the Forest Protection Department, and WWF and a local newspaper organised a contest which encouraged school children to name the Tiger. Now, with a new name, she is adjusting to a new life in captivity. The young Tiger has become one of the more popular exhibits at the zoo, and alongside her cage is a signboard which details her capture by wildlife traders, her ride in a taxi, and the police investigation into the smuggling ring which tried to ship her off to the markets in China. Hopefully, this sad story about one young Tiger is striking a chord amongst young children in Vietnam that will turn them off from the unnecessary purchase and use of wildlife products.

D. L. Hulse, WWF Indochina Programme

Box 3: even when traders are caught red-handed with the animals still alive, it may still be impossible to reverse their actions.

and R. J. Tizard verbally 1998). Parts for medicine are more portable, less readily recognisable and more easily hidden than are trophies, meaning that control may be more difficult.

The current information concerning international trade in the focal species and the needs and methodologies of trade regulation are discussed in Mills and Jackson (1994), Dinerstein *et al.* (1997), Menon *et al.* (1997), Nash (1997a) and Mainka (1997) with additional recommendations specific to Indochina in Baird (1993), Nash (1997b), Le Xuan Canh *et al.* (1997b) and Compton (in prep. a, in prep. b). Little has been published specifically on wild cattle trade despite recent detailing of the magnitude of the problem by Srikosamatara *et al.* (1992) and Srikosamatara and Suteethorn (1994, 1995).

Trade in these species is largely international, so cross-boundary action is necessary. However, as of 1997, neither Cambodia nor Lao were parties to any bilateral agreements to monitor or regulate wildlife trade; Vietnam and China have a trade control agreement as has the former with Taiwan (Mainka 1997).

Traders, at least locally, are so open as to indicate that no major risk is perceived. A man in Ban Lung, northeast Cambodia, discussed his turnover of Tigers (up to 3-4 per month, mainly to Vietnam), showed wild cattle trophies, and pointed out that the few check points are easily paid off; detection and / or punishment are so lax that Tiger parts are transported in rice sacks by public bus to southern Lao (Wikramanayake 1998). Another trader plans to export about 20 elephants from Cambodia to China in 1998, the majority from unspecified locations in Kompong Speu Province. Last year about six were sent. No further details are available (Chhun Sareth verbally 1998).

A few specific points deserve action:

- Profiles of typical poachers and traders, assessing how important involvement with the focal species is to them, would help for policy formulation.
- Understanding the destination and route of wildlife products will also help target anti-trade policies.
- Asian Elephant hides poached in Burma are smuggled to China for the recently-developed industry for elephant-skin bags, shoes, belts etc. (Santiapillai 1997). The elephants of Lao and Yunnan Province itself may be at risk from this; trade monitors should be vigilant for skin.
- Fake ivory and Tiger derivatives are widespread and may be difficult to separate from the original (Mainka 1997, Menon *et al.* 1997); trade researchers should take considerable care with identification when assessing stock and trade levels in these items.
- Tamed elephants' tusks are cut regularly (Menon *et al.* 1997; personal observation in Lao and Vietnam) and legal provision is needed for the storage and / or sale of the cut ivory.
- Lao intends to become a party to CITES; the Lao Government is debating which body should be the Scientific Authority, and which the Management Authority. Source for payment of fees is also yet to be identified (Venevongphet, S. Sawathvong verbally 1998). These issues should be resolved swiftly.

- As CITES is only as effective as member countries' legislation, so development and enforcement of appropriate national laws are essential. Lao wildlife trade law is under review; new laws should reflect that the country is likely to become a party to CITES.
- All four countries' domestic legislation should reflect the spirit of CITES.
- Support and technical training to bodies responsible for enforcing CITES, from higher administrative levels to individual border guards, are necessary.
- Banteng is not listed on any appendix of CITES; as international trade greatly threatens its survival, it should be added to Appendix I (no commercial trade allowed) at the next opportunity.
- The very large financial rewards from organised crime in focal species trade, and the rapid population decreases suggest that punishments of convicts should be comparable to the most severe dispensed in the country (see also sect. 5.10.4).

6.6 Captive breeding

The focal species are all numerous in captivity and breed well. The genetic make-up of many captive animals is uncertain, but even so, taking further individuals from the wild (to allow better captive breeding programmes) is inappropriate and any suggestions to do so should be resisted strongly. The species are all flagships for protecting extensive wilderness areas; if they are removed, that boost to ecosystem conservation is lost. Furthermore, captive breeding programmes are expensive and can divert scarce resources (financial, technical and media) from more important conservation endeavours.

Equally damaging is that captive breeding is relatively simple compared with *in situ* conservation as few intractable policy issues need facing up to. Large areas of land are not needed and rampant poaching of wild animals and resource-use issues can both be ignored. A captive breeding programme can give a false sense of achievement when all the while nothing is done to address the issues at the root of biodiversity loss and environmental impoverishment. At worst, a misplanned, poorly-managed programme can hasten the species's population decline (Caughley 1994, Rabinowitz 1995c).

None of the four focal species is yet so rare that taking the remaining individuals into captivity could be argued to be the only possible action to prevent permanent total global loss of the species. Were Kouprey or Khting Vor confirmed still to exist, captive management might well be the best option to prevent extinction.

These species are popular animals, among the staple exhibits of zoological gardens throughout the ages; they remain perennial money-spinners at the entrance gate. Ongoing captive programmes should therefore be funded from entirely within the zoological garden community, without recourse to external conservation-related funding. Indeed, the publicity surrounding, and the appeal of, such animals in captivity (especially if badged as 'rescued') means that they should better be regarded as possible channels of funds to *in situ* conservation.

Managing wild populations of cattle and elephants by fencing and guarding

restricted areas of natural habitat could be considered, as policing effectively the large areas needed by truly wild populations seems an insuperable challenge now. **This suggestion must not be taken as an alternative to protected area declaration and management.** It could preserve only few animals but may be important:

- Representative gene-pools from populations otherwise doomed can be preserved.
- The animals may be a valuable educational and research resource.

The proposed Asian Elephant reserve at Tan Phu, Don Nai Province (sect. 6.3.5) may, because of its small area and potential for human-animal conflict, have to use active controlled management techniques. In Lao the situation with wild cattle is so precarious that consideration should be given to this style of management (Fernando in prep.).

6.7 Public awareness

Public awareness campaigns to raise the profile of challenges and possible solutions to focal species conservation are among the most important long-term actions in the region. The structure and implementation of such campaigns is outside the competence of the present authors, but at least the following issues need to be addressed:

- why such declines should be reversed and the species conserved;
- contents of relevant statutes and laws, and punishments likely for convicted offenders;
- the importance of maintaining an adequate prey base for Tigers;
- agricultural and husbandry techniques to reduce human-animal conflict;
- trade issues as driven by medicinal use and trophy collection;
- the use of alternatives in medicine, and the recent excision of Tiger derivatives from the official traditional Chinese medicine pharmacopoeia;
- the need for the conservation of large wildernesses for these species and how this benefits other wildlife and the ecosystem as a whole;
- the dangers of easing access (with roads and bridges) to protected areas prior to the presence of active, committed patrolling staff;
- effects on the focal species and actions to forestall problems associated with large development projects (sects 6.3.6, 6.4);
- voluntary re-settlement options away from conservation areas; and
- why the potential eventual disappearance of these species concerns people outside the region (otherwise local people may be suspicious of external motivation; in the absence of sufficient communication, local people at a large Vietnamese protected area interpreted a baseline survey as an inventory prior to asset-stripping by the bilateral aid project; J. L. Walston verbally 1998).

One immediate priority is the preparation of a background document aimed at wildlife managers and administrative bodies addressing elephant / Tiger-human conflict resolution. This should be modelled on the style of Osborn and Welford (1997).

Awareness programmes should target three key constituencies within the region; each should be clear from the start at which it is aiming:

- government agencies (national and local) and legislative bodies;
- strategic allies and partners, such as NGOs, education and research institutes, and private organisations; and
- human communities in areas important for the focal species.

Work with the broader public is also necessary. In much of Indochina, the areas retaining good numbers of focal species support a varied mix of ethnic groups, and work must take due account of this (see sect. 3.4.2).

Public education outside the region should primarily concern the problems caused by use of medicines and other products containing derivatives of the species, and the collection of trophies.

Review of existing campaigns would guide ongoing initiatives and shape new ones, but is difficult as the real effects of raising awareness are long term. Nonetheless, some points deserve consideration:

- Market research principles could be used to maximise impact. C. Inthavong (*in litt.* 1998) specifically feels that more research is needed into both design and distribution of materials.
- Appropriate media may vary within the region. Literacy is exceptionally high in Vietnam (rural male, 91%, female 82%; UNDP 1995), but much lower in Lao and Cambodia. The best balance between words and pictures thus differs, and treating an item for one country as a translatable template for use in the others is unlikely to maximise benefit.
- Images and messages should be accessible to local people, meaning that the English-language messages on posters may seem superfluous; but conversely they may be 'lifestyle advertisements' (subliminal suggestions that readers noting the message are likely to have a more 'developed' lifestyle).
- Roots of local animosity to the focal species and protected areas should be appreciated; long-term ecological benefits of diverse mammal communities are likely to count little against short-term agricultural damage caused by them, so educational campaigns should not focus on the former (Saberwal 1997).
- Local administrative bodies should not merely be posted a copy of a new law or policy and expected to get on with enforcement. Understanding the rationale of the law, what needs to be enforced and how to do so, and motivation are all higher if personal visits and discussions are made. These should be targeted at the provinces with the largest remaining numbers of animals (K. Khounbolin verbally 1998).
- Particularly with rural communities, regular follow-ups are more effective than a

one-off activity (Venevongphet verbally 1998).

The danger of missed messages is very real, but difficult to assess. An analogy from an expatriate-designed survey questionnaire may help indicate how wide the comprehension gap may be between well-educated and subsistence people. This questionnaire was designed to investigate the domestic elephant population of Dak Lak Province, Vietnam, and for each elephant, as well as questions like "date of capture" and "current location", included the question "noticeable features", intended to facilitate individual recognition of the animal. No guidance was given in filling in the questionnaire, and a substantial number of respondents gave answers like "Four legs. One tail. Two ears. One trunk", instead of the intended information such as "large rip in right ear" (Trinh Viet Cuong in prep.). Chances of similar misunderstandings with awareness programmes can be lowered by personal presence (as indicated above), before, during and after the main activity.

Conservation bodies should take and make opportunities for the media to present their aims and successes to the public. Too often, needs such as meeting deadlines put publicity low on the agenda; but all projects should promote understanding among the populace of what is being done and why. Mutterings that organisations in the media often are distastefully self-promoting miss the point that the whole conservation community must generate much higher regional support for focal species conservation. The WWF Indochina Programme has a specific Communications and Public Outreach Unit; there is considerable scope for other offices to do likewise.

6.8 Coordination of action

6.8.1 *Formulation of national action plans*

Successful conservation of the focal species needs coordinated "comprehensive conservation efforts on the part of individuals, organisations, and governments that [implement] programs of applied research, training, education, law enforcement, and wildlife management" (Weber and Rabinowitz 1996). The key role of sovereign government in co-ordinating the conservation of large mammals cannot be over-emphasised. *Ad hoc* measures - declare a national park here, fund an anti-poaching patrol there - are unlikely in the long term to protect species with high trade value. The design and co-ordination of action needs care and forethought. A recent draft action plan for Asian Elephant conservation in Vietnam was flawed for several reasons: government collaboration in formulating it was inadequate; current elephant status was not reviewed in detail; some recommendations seem arbitrary; and funding for implementation was erratic.

The highest priority action for international conservation organisations active in the region is to assist each national government to formulate action plans for very large mammal conservation as part of official policy and then to provide financial and technical assistance for their implementation. Explicit incorporation into state policy should ensure achievable recommendations, as the onus for meeting targets is placed upon the government. The Sarawak state

government recently endorsed as official policy a wildlife master plan drafted jointly by its own National Parks and Wildlife Office (of the Forest Department) and an international NGO (Wildlife Conservation Society). During implementation of the plan, the NGO therefore is, and is seen as, a facilitator of government policy, rather than a potentially bothersome critic.

Formulating such an action plan needs two lead partners, the relevant government department and an international NGO, with input from all other relevant parties: conservation and social scientists, surveyors, protected area staff, provincial and local administrative staff, etc. Local participation is essential for realistic aims to be set. C. Inthavong (*in litt.* 1998) suggests that the appropriate procedure, at least in Lao, is for participatory workshops in high priority areas (e.g. Nam Theun catchment; Xaignaboul Province; perhaps 3-4 in total) to discuss topics drafted by CPAWM in advance. As the entire process would take about a year, limited funding for pilot, priority, activities during this time might be desirable.

Each plan should nominate specifically the agencies responsible for executing each recommendation, so that the general accountability of the government is transferred to the end-of-line executives.

Planning for the focal species together is more efficient than treating each separately (see Part 1), but as the procedure is novel, correspondents in Lao suggested starting with one species and expanding subsequently. The decision depends upon the individual people and the resources available.

A regular review (perhaps annually) should from the start direct progress and respond to implementation challenges.

Simultaneous action plan development in four countries would be an enormous undertaking. The process should be first initiated in Lao, as this country has the large tracts of land necessary for focal species conservation, the political stability to design a plan and enact the recommendations, and perhaps the most important focal species populations. Cambodia retains the land and at least locally the populations, but many uncertainties may limit achievement. Vietnam has limited possibilities for conserving these species, resulting from factors including very high human population densities and consequent extreme pressure on land (sect. 3.1.7; Johnsingh and Nguyen Huu Dung 1995). Action in Yunnan Province will be centred so strongly on Xishuangbanna National Nature Reserve that, while other areas may be important, Yunnan would not be an ideal first area for developing the concept.

6.8.2 *International co-operation*

Continuing international co-operation is needed for conserving the focal species in the region. Action is needed in two main fields:

- collaboration between countries in policy development and implementation; and
- provision of international resources (financial and technical).

Continued inward skills transfer is essential for all four countries. The role of international organisations is considered in sect. 6.8.4.

The momentum from a 1994 workshop on trans-boundary conservation for the

region, continued in a subsequent meeting (Ji Weizhi and Rabinowitz 1995, Rabinowitz 1994, 1995b), should be maintained. Correspondents in Yunnan Province in particular commented that after the initial fanfare, little was happening. Extending the UNDP-supported RAS/93/102 Subregional Biodiversity Project (currently Lao, Cambodia and Vietnam with Thailand as a technical / human capacity resource country) to include Yunnan should be considered. Yunnanese large mammals, notably Asian Elephant, move into Lao and the marked biogeographical similarities beg better dialogue. Furthermore, the concentration of skills and experience in Yunnan could and should be transferred southwards.

Trans-boundary areas important for the focal species are listed in sect. 5.8.

All regional work should take the advice and input of the relevant international bodies. The IUCN/SSC Cat Specialist Group is one of several think-tanks / repositories of information which considers Tigers; its newsletter, *Cat News*, is essential reading for all engaged in cat conservation. Other bodies include the Tiger Information Centre (Minnesota Zoo, USA; it formerly produced the newsletter *Tiger Beat*), and the Ranthambore Foundation (which produces *Tiger Link*).

The Asian Elephant Conservation Centre (set up in 1989, and shortly to be renamed the Asian Elephant Research and Conservation Centre) at the Indian Institute of Science in Bangalore, India is the technical secretariat of the IUCN/SSC Asian Elephant Specialist Group; the latter produces the journal *Gajah*.

The wild cattle are the least well represented by international alliances. The IUCN/SSC Asian Wild Cattle Specialist Group, following publication of the global action plan currently in preparation, will produce a regular newsletter.

6.8.3 The need for long-term external funding

Conserving the focal species entails substantial short-term opportunity costs. Large areas are necessary, but they cannot simultaneously generate income through plantations, agriculture or industry, or even be used for subsistence; trying to overlap the latter with Tiger and Asian Elephant conservation is certain to produce human-wildlife conflict.

Even where economic grounds drive habitat conservation (e.g. in hydropower headpond catchments), maintaining focal species populations is not an obvious part of this. Expensive additional management is usually needed. Eco-tourism seems to be the only potential short-term financial benefit from the focal species, but there is not enough of it to fund all protected areas in Indochina (see also sect. 5.10.1).

These opportunity costs should be met externally, as there is a danger that restricting the development options of inhabitants of areas retaining focal species populations seems like a 'punishment' for not having hunted them out fast enough; meanwhile, communities who have already eradicated their elephants, cattle and big cats are 'rewarded' with a freer reign over land use. The understanding among villagers that without Tigers there can be no tiresome need to modify one's behaviour in their interest is likely to spread, and is analogous to the many English farmers ruining sites of wildlife importance on their land before the government imposes development limitations (e.g. MacLochlainn 1995).

It is unrealistic for the people who most wish to preserve these mammal species

into the future to expect the costs to be footed by those least able to pay them. If the international community wishes to preserve these species for the global benefit, they must pay for the privilege by funding management of high priority areas, until a local conservation ethos coupled with sufficient local affluence develops. The famous anthropologist Margaret Mead suggested that it takes about a generation (30 years or so) for a new idea to take root in the public mind (Johnsingh and Goyal 1995). This was certainly so for the time needed in England for birds' egg collecting to change from being a common boyhood pastime, to an exceptional activity. It suggests that international funders of protected area management projects in Indochina need at least to be planning in decades, not single-figures of years.

Ratification of international treaties by the Indochinese governments (for example Vietnam is a signatory to the Biodiversity Convention), and political willingness to tackle the issues within them, send a clear signal for such international funding. By contrast, some developments absolutely incompatible with protected area status have been sanctioned in flagship protected areas in Indochina; at least one hosts a major internationally-funded management project. Behaviour such as this, suggesting that local administration has not 'bought into' protected areas politically, is unlikely to stimulate the outside world further to 'buy into' management of the areas financially.

All African ICDPs reviewed by Alpert (1996) relied primarily on foreign support. Alpert (1996) discusses the philosophical issues raised by acceptance of prolonged self-insufficiency of wildlife conservation in poor countries. The short timescale for conserving the focal species in Indochina means that this philosophy needs speedy embracing so that effort can be concentrating on making real headway with issues on the ground.

6.8.4 The role of international organisations

International organisations are important in conserving the focal species. Each organisation should define its sphere of influence, set priorities within that, and be responsible for subsequent action (and the lack of it). Publicly defined spheres of influence would promote better use of conservation resources in the region. There are some durable and productive collaborations in the region (e.g. IUCN and WCS in Lao), but in some other cases poor communication and collaboration between different organisations duplicates and mis-directs effort. In India, "NGOs ... squabble, fight and compete. Instead of being potent, they disperse their energies in endless infighting resulting in inaction in the field where it matters" (Thapar 1996); NGOs and other bodies active in Indochina should take positive steps to ensure that the situation is one of strength through co-operation rather than empty dominance through competition.

Triage

Conserving everything still extant will not be possible. Responsible triage should ensure that the finite conservation resources are used in the best way. Various factors should be considered by international organisations in prioritising activity:

- Importance. A population is more important if it is larger, helps maintain the

species's ancestral range, or may be genetically distinct, than is a small population in an area with several other such populations. Similarly, the benefits from influencing policy should be considered. Lowering the demand for Tiger parts in Chinese medicine would have a much greater effect on Tiger numbers than preventing villagers from killing man-eaters.

- Achievability. Resources are better used pragmatically, than over-ambitiously.
- Secondary effects, negative and positive. Broad environmental benefits might include 'flagship potential' to maintain habitat and threatened but less charismatic species, or increased national conservation awareness; unexpected negative side-effects (e.g. replacing Tiger products with parts of other cat species in Chinese medicine preparations) should be minimised.
- Training potential. For example, congenial field conditions allow a more positive working atmosphere for most people than do semi-permanent rain, rugged terrain infested with leeches and makeshift living quarters.
- Education potential.

All work considered by international organisations should be evaluated against these criteria. Difficult decisions will be necessary: as Leader-Williams *et al.* (1990) point out, "the need to concentrate effort and be selective when resources are short does not come easily to conservationists (Leader-Williams and Albon 1988, Parker and Graham 1989), but is a policy that is readily accepted by military tacticians or businessmen (von Clausewitz 1976: 204, Kraushar 1985: 45)".

Two examples of the sort of issues to be resolved follow:

- Prioritising populations. The global importance of the Asian Elephants of Vietnam is now so low and challenges for their conservation so daunting that channelling substantial elephant conservation resources into Vietnam would be hard to justify. In Cambodia the breakdown of law and order currently prevents the active management of protected areas. To maintain a viable Indochinese Asian Elephant gene-pool, resources should therefore be directed to Lao and Yunnan Province, not to Vietnam or Cambodia. There is important elephant-related conservation work in Vietnam (e.g. protecting small herds in accessible areas as educational / research resources) and Cambodia (institutional capacity building and educational awareness, so that activities can start when the security situation improves), but clear understanding of the rationale behind such work is needed.
- Prioritising protected areas. Funds and skilled personnel are limited; areas less important for the focal species should not drain resources for their conservation, thereby weakening the more important areas. Declaration of core areas within Lao National Biodiversity Conservation Areas is an urgent measure necessary to allow their protection on the ground. From a national perspective, a tiered structure for core area funding and provision of expertise should be designed, using (in recognition of the flagship role of Tigers and the other focal species) a measure of biodiversity importance in general, not solely focal species status. National action plans (sect. 6.8.1) should address these issues decisively and explicitly.

Local capacity building

International organisations should continue to build local capacity. This involves selecting local participants for data collection and analysis, and report preparation and presentation. Skills transfer needs adequate external supervision. In several reports reviewed, the international organisation had printed uncritically the offerings by the local team. Even if anybody with even basic knowledge of wildlife and an international perspective on the style and functions of reports had read a draft, the report was not revised to incorporate their views.

An error-packed report neither succinct nor digestible may hinder subsequent policy making, but worse is that a valuable opportunity has been missed to strengthen local capability. Many people learn best by constructive discussion of their own work. Bulk training courses and instruction manuals prepare the ground, but individuals achieve more with specific directed advice. Internationally, peer review of written output is standard; in Indochina, international organisations should initiate this.

Even some reports with internationally sourced input were misleading or inaccurate (see sect. 3.2.5). One external consultant confessed that he had no confidence in the veracity of information in the report of his survey. The Terms of Reference of external surveyors should specify that they are responsible for ensuring a reputable report.

Selecting counterparts for overseas workers is problematical in at least Vietnam, Lao and Cambodia as there are few suitable people compared with the number desired. Donor bodies often insist that personnel are government staff, thereby further stressing the overstretched departments (C. Inthavong, S. Sawathvong verbally 1998). More flexible donors allow free selection of people and fund them on secondment to the government; those performing well can then be taken on full time by the government. This has recently happened with several successful people in Lao. Counterpart selection is considered further in sect. 4.5.2.

Field training, if done 'on-job', achieves more if preceded by an intensive course (K. U. Karanth *in litt.* 1998). The low density of the focal species in Indochina means that such courses are not best held in the region. More can be demonstrated where numerous signs can be studied (e.g. parts of Thailand or, ideally, India, Nepal or Sri Lanka). A 1996 attempt to arrange just such a course failed, as the prior time and administration needed was under-estimated, although an earlier awareness-raising venture was successful (Johnsingh and Goyal 1995).

Some organisations have sent many promising students on overseas academic courses. C. Inthavong (*in litt.* 1998), among others, is concerned that donor-driven selection for overseas Master's courses rather than for Bachelor's degrees (or equivalent) prevents some such students from achieving their full potential. More open recognition that home-awarded Bachelor's degrees may be insufficient preparation for overseas Master's degrees should change donor policy.

International bodies should encourage talented local scientists to participate in the relevant specialist groups of IUCN's Species Survival Commission. The dialogue and liaison these groups promote between researchers with shared interests and goals is one of the most solid ways to mature individuals, who even today are somewhat

isolated from developments and advances in their field elsewhere in the world, even in neighbouring countries.

International bodies should encourage the establishment of local NGOs. In India, these spawn talent and lead to a better understanding of areas, issues and the strategies to be employed (V. Menon *in litt.* 1998).

AFTERWORD: THE ROLE OF THE FOCAL SPECIES IN BIODIVERSITY CONSERVATION IN INDOCHINA

Understanding and managing every facet of biodiversity is so difficult that biologists try to take short cuts by using selected species. Simberloff (1998) reviewed the development, strengths and weaknesses of 'indicator' species, 'umbrella' species, 'flagship' species and 'keystone' species at a time when species focus *per se* is challenged by landscape ecology and ecosystem management. All species-based conservation concepts have flaws (Simberloff 1998). Is it, then, appropriate to present a review such as this, focused upon four species?

In principle, the answer is in the affirmative: landscape-based philosophy may be equally flawed, and more damaging, as it and its management goals are ill- (and variously-) defined, untested, arguably untestable, and there is no *a priori* basis for assuming that many individual species are indispensable to the ecosystem processes that such management seeks to protect (Grumbine 1994, Simberloff 1998).

In practice, the wide variety of topics discussed here to give the background information necessary to set national action plans in appropriate perspective vindicates a species-based approach. Issues reviewed are as diverse as the pitfalls inherent in Integrated Conservation and Development Projects, sign survey methodology, the pressing need for local capacity building, the dangers of road construction into remote areas, the need for regulation of subsistence hunting, the design of protected areas, the locations retaining populations of some of the most endangered large mammals in the world, the problems in controlling lucrative international smuggling, and so on. This suite of diverse topics demonstrates that **the focal species are ultimate umbrella species for policy**: protect them, and most other species must be practicably conservable.

Defining keystone species and understanding their roles is subjective (Paine 1995, Hurlbert 1997, Simberloff 1998) and they are not discussed further here.

The role of Tiger as one of the most powerful flagship species in the world is unquestioned. For example, the United States Department of the Interior Fish and Wildlife Service operates a Rhinoceros and Tiger Fund which dispenses annually sums of money which no non-commercial species other than a large charismatic mammal could command. **Asian Elephant is also a powerful resource puller** and while wild cattle lag considerably behind, the potential for the Kouprey, a legend in its own lifetime, to inspire work is enormous: should a population ever be found again, it will be seen as one of the highest-interest conservation projects in the world.

Thus, the pedigrees of the species in these roles are impeccable, but arguably, their main value is to reflect glory, and thus conservation, on the biodiversity of Indochina. For this, the focal species should be good indicators. If these four species are conserved in the wild, how much else will necessarily be kept?

Arguably, species endemic to Indochina are of the highest regional conservation priority as, if they are not conserved in the region, there are no other options. The

known distributions of Indochinese endemics in Lao show that **the focal species are not great indicators of areas of importance**. While some species would be well catered for (e.g. Inornate Squirrel *Callosciurus inornatus* and Grey-faced Tit Babbler *Macronous kelleyi*), one of the prime areas for restricted-range species is the mid and high altitude evergreen forests of the Annamites, centred on the Nam Theun basin. Areas important for Saola *Pseudoryx nghetinhensis*, Giant Muntjac *Megamuntiacus vuquangensis*, Indochinese Pig *Sus bucculentus*, unresolved small muntjacs *Muntiacus* spp., several small carnivores and a suite of birds (Schaller and Rabinowitz 1995, Schaller and Vrba 1996, Duckworth 1997, Groves *et al.* 1997, Timmins *et al.* 1998, Thewlis *et al.* in press) are outside the habitat types favoured by the focal species (sect. 5.2) although at least Tigers and Gaur occur (e.g. Duckworth in press). Furthermore, some of the most critically threatened mammal taxa in Indochina today are various langurs with very limited geographical ranges, living mainly on limestone (e.g. Nadler 1996); these areas rarely support the focal species.

A clear balance is thus important between the needs of the focal species, and those of the other priority species in the region. With this caveat in mind, it can now be stated that at the level of species richness (a measure often conceived, erroneously, as synonymous with biodiversity or with biodiversity importance), the favoured habitats of the focal species - lowland areas supporting a mix of evergreen and deciduous forests and a variety of water sources - are probably among the most speciose in South-East Asia, and so **from this perspective the focal species are good indicators of sites important to conserve.**

Indicator species can also be used to indicate how successful conservation of an area is. The ability of the focal species to thrive in areas with substantial habitat alteration means that they are probably weak indicators of the conservation status of the entire complement of species in an area.

Thus, while the focal species have a major role in the conservation of biodiversity in Indochina, excessive focus on them would be detrimental. Striving to balance the needs is the challenge to all parties active in the conservation of Indochina's biodiversity.

REFERENCES

- Alpert, P. 1996. Integrated Conservation and Development Projects: examples from Africa. *Bioscience* 46: 845-855.
- Alvard, M. S. 1994. Conservation by native peoples: prey choice in a depleted habitat. *Human Nature* 5: 127-154.
- Anon. 1992. Tigers threatened in Vietnam. *Cat News* 16: 5.
- Anon. 1995a. Poaching continues to take heavy toll of Tigers. *Cat News* 23: 2-3.
- Anon. 1995b. Javan (?) Rhino in Vietnam. *Asian Rhinos* 1: 11.
- Anon. 1996a. Asian cooperation to save the Tiger and its ecosystem. *Cat News* 24: 2-3.
- Anon. 1996b. Tigers toll in India, Nepal and Vietnam. *Cat News* 24: 3.
- Anon. 1998. Reducing man-animal conflict. *Tiger Update* (April 1998): 3. New Delhi: WWF Tiger Conservation Programme, WWF India.
- Aulak, W. and Babinska-Werka, J. 1990. Estimation of Roe Deer density based on the abundance and rate of disappearance of their faeces from the forest. *Acta Theriol.* 35: 111-120.
- Baird, I. 1993. *Wildlife trade between the southern Lao PDR provinces of Champasak, Sekong, and Attapeu, and Thailand, Cambodia and Viet Nam*. TRAFFIC Southeast Asia (Field report 3).
- Baird, I. G., Tughtim, K. and Baird, M. 1996. *Observations of livelihoods and natural resources in two highlander villages in the districts of Veun Say and Ta Veng, Ratanakiri Province, Cambodia*. Unpubl. report to NOVIB and Oxfam.
- Balasubramanian, M., Baskaran, N., Swaminathan, S. and Desai, A. A. 1995. Crop raiding by Asian Elephants (*Elephas maximus*) in the Nilgiri Biosphere Reserve, South India. Pp. 350-367 in Daniel, J. C. and Datye, H. (eds) *A week with elephants*. Bombay, India: Oxford University Press.
- Bann, C. 1997. *An economic analysis of tropical forest land use options, Ratanakiri Province, Cambodia*. Singapore: Economy and Environment Program for Southeast Asia.
- Barnes, R. F. W. 1979. *Elephant ecology in the Ruaha National Park, Tanzania*. PhD thesis, University of Cambridge, UK.
- Barnes, R. F. W. 1993. Indirect methods for counting elephants in forest. *Pachyderm* 16: 24-30.
- Barnes, R. F. W. and Jensen, K. L. 1987. How to count elephants in forests. *IUCN/SSC African Elephant and Rhino Spec. Grp Tech. Bull.* 1: 1-6.
- Barnes, R. F. W. and Kapela, E. B. 1991. Changes in the Ruaha elephant population caused by poaching. *Afr. J. Ecol.* 29: 289-294.
- Barnes, R. F. W., Asamoah-Boateng, B., Naada Majam, J., and Agyei-Ohemeng, J. 1997. Rainfall and the population dynamics of elephant dung-piles in the forests of southern Ghana. *Afr. J. Ecol.* 35: 39-52.
- Barnett, A. 1995. *Expedition field techniques: primates*. London: Expedition Advisory Centre.
- Barnhurst, D. and Lindzey, F. G. 1989. Detecting female mountain lions with kittens. *Northwest Science* 63: 35-37.
- Barrett, C. B. and Arcese, P. 1995. Are integrated conservation-development projects (ICDPs) sustainable? On the conservation of large mammals in sub-Saharan Africa. *World Development* 23: 1073-1084.
- Barzen J. 1994. ICF team discovers rare wildlife in Cambodia. *ICF Bugle* 20 (4): 3-4.
- Beck, C. 1884. *Temples and elephants*. London: Sampson Low.
- Beier, P. 1993. Determining minimum habitat areas and habitat corridors for Cougars. *Conserv. Biol.* 7: 94-108.
- Beier, P. and Cunningham, S. C. 1996. Power of track surveys to detect changes in Cougar populations. *Wildl. Soc. Bull.* 24: 540-546.
- Bergmans, W. 1995. On mammals from the People's Democratic Republic of Laos, mainly from

- Sekong Province and Hongsa special zone. *Z. Säugetierk.* 60: 286-306.
- Berkmüller, K. 1995. *Hydropower development and protected areas: problem analysis*. Unpublished report to Lao-Swedish Forestry Co-operation Programme.
- Berkmüller, K. and Vilawong, W. 1996. *A rapid wildlife and habitat survey of Dong Khanthung Conservation Forest and its environs*. Pakxe, Laos: Provincial Agriculture and Forestry Office / IUCN.
- Berkmüller, K., Phanthavong, B. and Venevongphet. 1993. *Protected areas system planning and management in Lao PDR. Status report to mid-1993*. Vientiane: IUCN / LSFCP.
- Berkmüller, K., Southammakoth, S. and Vongphet, V. 1995a. *Protected areas system planning and management in Lao PDR. Status report to mid-1995*. Vientiane: IUCN / LSFCP.
- Berkmüller, K., Evans, T., Timmins, R. and Vongphet, V. 1995b. Recent advances in nature conservation in the Lao PDR. *Oryx* 29: 253-260.
- Blair, J. A. S., Boon, G. L. and Noor, M. M. 1979. Conservation or cultivation: the confrontation between the Asian Elephant and land development in peninsular Malaysia. *Abstracts of Land Development Digest* 2: 25-58.
- Bodmer, R. E. 1994. Managing wildlife with local communities in the Peruvian Amazon: the case of the Reserve Communal Tamshiyacu-Tahuayo. Pp. 113-134 in Western, D. and Wright, R. M. (eds) *Natural connections: perspectives in community-based conservation*. Washington DC: Island Press.
- Boonratana, R. 1997. *Field training in wildlife techniques and large mammal survey at Nam Phui National Biodiversity Conservation Area, Lao PDR*. Vientiane: IUCN.
- Boonratana, R. 1998a. *Wildlife survey training at Dong Hua Sao and Phou Xiang Thong National Biodiversity Conservation Areas, Lao PDR*. Vientiane: IUCN.
- Boonratana, R. 1998b. *Field management of Nam Poui and Phou Xang He National Biodiversity Conservation Areas*. Vientiane: IUCN.
- Borner, M. 1978. Status and conservation of the Sumatran Tiger. *Carnivore* 1: 97-102.
- Brandon, K. 1996. *Ecotourism and conservation: a review of key issues*. Washington DC: World Bank Environment Department (paper 033).
- Brix, P. and Deuve, J. 1963. Note sur les terres salées de la région de Pakcading. *Bull. Soc. Roy. Sci. Nat. du Laos* 6: 28-35.
- Brockelman, W. Y. and Ali, R. 1987. Methods of surveying and sampling forest primate populations. Pp. 23-62 in Marsh, C. W. and Mittermeier, R. A. (eds) *Primate Conservation in the Tropical Rain Forest*. New York: Alan R. Liss.
- Byers, O., Hedges, S. and Seal, U. S., eds. 1995. *Asian wild cattle conservation assessment and management plan workshop. Working document*. Apple Valley, MN, USA: IUCN/SSC Conservation Breeding Specialist Group.
- Cadière, L. 1934. La chasse à Hué. *Bull. des Amis de Vieux Hué* 4: 328-332. (cited in WWF/EC 1997).
- Caughley, G. 1994. Directions in conservation biology. *J. Anim. Ecol.* 63: 215-244.
- Chan Sarun. 1992. The elephants of Cambodia. Pp. 56-57 in Asian Elephant Conservation Centre (comp.), *Asian Elephant Specialist Group Meeting, Bogor, Indonesia, 20-22 May, 1992: proceedings*. Bangalore, India: AECC.
- Chay Samith, Oum Pisay and Ros Choir. 1995 *Current status of Virachey National Park, Ratanakiri Province*. Phnom Penh: Ministry of the Environment.
- Claridge, G. F. (comp.) 1996. *An inventory of wetlands of the Lao PDR*. Bangkok: IUCN.
- Compton, J. in prep. a. *Borderline: an assessment of wildlife trade in Vietnam*. Hanoi: WWF Indochina Programme.
- Compton, J. in prep. b. *Vanishing point: an investigation into cross-border wildlife trade between Laos and Vietnam*. Hanoi: WWF Indochina Programme.
- Cox, C. R. 1994. *A management feasibility study of the proposed Na Hang (Tonkin Snub-nosed Monkey) Nature Reserve, Tuyen Quang Province, Vietnam*. Gland, Switzerland and Cambridge, UK: IUCN/SSC.
- Cox, R. and Ha Dinh Duc. 1990. *Survey for Kouprey in the Yok Don Nature Reserve, Dak Lak*

- Province, Viet Nam. Kouprey Conservation Trust.
- Cox, R., Laurie, A. and Woodford, M. 1992a. *The results of four field surveys for Kouprey Bos sauveli in Viet Nam and Lao PDR*. Kouprey Conservation Trust.
- Cox, R., Vu Van Dung and Pham Mong Giao. 1992b. *Report of a management feasibility study of the Muong Nhe Nature Reserve (November/December 1991)*. Hanoi: WWF Indochina Programme / Ministry of Forestry.
- Cox, R., Cools, J. W. F. and Ebreget, A. 1995. *Cat Tien National Park conservation project: project proposal*. Unpubl. proposal.
- Cracraft, J., Feinstein, J., Vaughn, J. and Helm-Bychowski, K. 1998. Sorting out Tigers (*Panthera tigris*): mitochondrial sequences, nuclear inserts, systematics, and conservation genetics. *Anim. Conserv.* 1: 139-150.
- Cunningham, A. A. 1996. Disease risks of wildlife translocations. *Conserv. Biol.* 10: 349-353.
- Daim, M. S. B. 1992(?). *In service training in translocation techniques for elephants*. Unpubl. proposal to WWF Indochina Programme.
- Dang Huy Huynh and Tran Anh Tuan. 1991. Preliminary results of estimating population of oxforest (*Bos banteng*) in Dipterocarpacea forest ecosystem on Yokdon reserve-Daklak Province. *Tap Chi Sinh Hoc* 13 (1): 30-32. [In Vietnamese with English title and summary.]
- Dang Huy Huynh, Truong Minh Hoat and Bui Khin. 1979. Buoc dau tim hieu khu he thu (Mammalia) o tinh Gia Lai-Kon Tum [Preliminary study of the mammals of Gia Lai-Kon Tum Province]. *Tap Chi Sinh Vat Hoc*, 1 (4): 27-31. [In Vietnamese.]
- Dang Huy Huynh, Hoang Minh Khien, Vu Thi Thuy and Dang Ngoc Can. 1980. Nguon loi thu (Mammalia) o tinh Dak Lac [Mammal resources of Dak Lak Province]. *Tap Chi Sinh Vat Hoc* 2 (4): 24-29. [In Vietnamese.]
- Dang Huy Huynh, Hoang Minh Khien and Cao Van Sung. 1982. Buoc dau dieu tra khu he thu cua tinh Lam Dong [Preliminary research into the mammals of Lam Dong Province]. *Tap Chi Sinh Vat Hoc* 4 (2): 27-30. [In Vietnamese.]
- Dang Huy Huynh, Sokolov, V. E., Kuznesov, G. V., Hoang Minh Khien and Pham Trong Anh. 1984. The composition and distribution of mammals in Konhanung region (Province Gialai-Kontum). *Tap Chi Sinh Hoc* 6 (1): 26-32. [In Vietnamese with English title and summary.]
- Dang Huy Huynh, Cao Van Sung, Pham Trong Anh and Hoang Minh Khien. 1990. Wild mammals in deciduous forest Yokdon. [Selected collection of scientific reports on ecology and biological resources (1986-1990)] 13-16. [In Vietnamese with English title and summary.]
- Dang Huy Huynh, Cao Van Sung and Le Xuan Canh. 1995a. *A report on the survey for biological resources in Yok Don National Park, South Vietnam*. Hanoi: IEBR.
- Dang Huy Huynh, Hoang Minh Khien and Le Xuan Canh. 1995b. A study of the structure of animal diversity in Tuyen Quang Province and measures for its conservation and sustainable development. In: *Selected collection of scientific reports on ecological and biological resources*. Hanoi: Publishing House Science and Technics. (In Vietnamese with English summary and title.)
- Dang Huy Huynh, Cao Van Sung and Le Xuan Canh. 1997. *A report on conservation research on biodiversity and ecological structure of some groups of plants and animals in Yokdon National Park (Daclac) and Cat Ba National Park (Hai Phong) and measures for conservation and sustainable development*. Hanoi: IEBR.
- Dang Zui Khun, Le Suan Kan and Puzachenko, Y. 1991. Large mammals of small-leaved deciduous forests in the Srepok river basin (South Vietnam). *Zoo. Zh.* 70 (3): 154-157. [In Russian with English title and summary.]
- Daniel, J. C. 1993. The Asian Elephant: future prospects. *Gajah* 11: 2-5.
- Dao Van Tien and Tran Hong Viet. 1984. Danh sach thu o huyen Sa Thay [List of mammals of the Sa Thay District]. *Tap Chi Sinh Hoc* 6 (2): 28-30. [In Vietnamese.]
- Datye, H. S. and Bhagwat. 1995. Estimation of crop damage and the economic loss caused by elephants and its implications in the management of elephants. Pp. 375-388 in Daniel, J. C. and Datye, H. (eds) *A week with elephants*. Bombay, India: Oxford University Press.
- Davenport, D., Tizard, R. and Phommavongsa, V. 1997. *Trip report: Ban Mai*. Vientiane: unpubl. report to WCS.
- Davidson, P. (ed) in press. *A wildlife and habitat survey of Nam Et and Phou Loey NBCAs*,

- Houaphanh Province, Lao PDR. Vientiane: CPAWM/WCS.
- Davidson, P., Robichaud, W. G., Tizard, R. J., Vongkhamheng, C. and Wolstencroft, J. 1997. *A wildlife and habitat survey of Dong Ampham NBCA and Phou Kathong proposed NBCA, Attapu Province, Lao PDR*. Vientiane: CPAWM/WCS.
- Dawson, S. 1996. *Vietnam's vanishing elephants: a species survival strategy*. Hanoi: FFI.
- Dawson, S. and Dekker, A. J. F. M. 1992. *Counting Asian Elephants in forests*. Bangkok: FAO-RAP.
- Dawson, S. and Do Tuoc 1997. Status of elephants in Nghe An and Ha Tinh provinces, Vietnam. *Gajah* 17: 23-35.
- Dawson, S., Do Tuoc, Le Vu Khoi and Trinh Viet Cuong. 1993. *Elephant surveys in Vietnam. Project VN0005*. Hanoi: WWF Indochina Programme.
- Delacour, J. 1940. Liste provisoire des mammifères de l'Indochine française. *Mammalia* 4: 20-29, 46-58.
- Delacour, J. and Jabouille, P. 1940. Liste des oiseaux de l'Indo-chine française complétée et mise à jour. *L'Oiseau R.f.O.* 10: 89-220.
- Deuve, J. and Deuve, M. 1962. Les grands félidés du Laos. *Bull. Soc. Roy. Sci. Nat. du Laos* 5: 79-86.
- Desai, A. A. and Lic Vuthy. 1996. *Status and distribution of large mammals in eastern Cambodia*. Phnom Penh: IUCN/FFI/WWF Large Mammal Conservation Project.
- Dinerstein, E., Wikramanayake, E., Robinson, J., Karanth, U., Rabinowitz, A., Olson, D., Mathew, T., Hedao, P., Connor, M., Hemley, G. and Bolze, D. 1997. *A framework for identifying high priority areas and actions for the conservation of Tigers in the wild*. WWF-US, WCS and NWF.
- Dinerstein, E., Rijal, A., Bookbinder, M., Kattel, B. and Rajuria, A. in press. Tigers as neighbors: efforts to promote local guardianship of endangered species in lowland Nepal. In: Seidensticker, J., Christie, S. and Jackson, P. (eds.) *Riding the Tiger: Tiger conservation in human dominated landscapes*. Cambridge, UK: Cambridge University Press.
- Dioli, M. 1994. *Report on a brief Kouprey (Bos sauveli) survey in Mondul Kiri Province, Kingdom of Cambodia*. Phnom Penh: Cambodian Kouprey Research Project.
- Dioli, M. 1995. A clarification about the morphology of the horns of the female Kouprey: a new unknown bovid species from Cambodia. *Mammalia* 59: 663-667.
- DNCP [Department of Nature Conservation and Protection]. 1995. *Preah Sihanouk National Park: integrating conservation and development-a management plan for the Preah Sihanouk National Park*. Phnom Penh: DNCP / IUCN.
- DNCP [Department of Nature Conservation and Protection] / IUCN. 1996. *Cambodia: a national biodiversity prospectus*. Phnom Penh: DNCP / IUCN.
- Do Tuoc. 1991. Elephants in Vietnam. Pp. 132-135 in *Summaries of research documents on forest inventory and planning 1961-1991*. Hanoi: FIPI, Ministry of Forestry.
- Do Tuoc and Le Trong Trai. in prep. *Ket qua danh gia hien trang dong vat rung quy hiem Viet Nam [Project for planning, protection and development of endangered species in Vietnam]*. [In Vietnamese.]
- Do Tuoc and Ngo Tu. 1995. *Dac diem khu he va nguon loi dong vat khu bao ton thien nhien [Characteristics of the Mom Ray Protected Area and the benefits from the animals]*. Hanoi: FIPI. [In Vietnamese.]
- Do Tuoc and Santiapillai, C. 1991. The status of elephants in Vietnam. *Asian Elephant Spec. Grp Newsletter* 7: 2-8.
- Do Tuoc, Nguyen Nhu Phuong, Vu Van Dung, Pham Nhat and Tran Quoc Bao. 1994. *Status and conservation of Tiger in Vietnam*. Text of presentation given at a meeting in Hanoi in 1994.
- Dobias, R. J. 1992a. *Trip report: Nakai Plateau and proposed Xe Pian Protected Area*. Vientiane: unpubl. report to LSFCP.
- Dobias, R. J. 1992b. *Trip report: Xe Bang Nouan proposed protected area*. Vientiane: unpubl. report to LSFCP.
- Dobias, R. J. 1993. *Conservation issues at Nam Theun Protected Area, Lao PDR*. Vientiane: unpubl. report to LSFCP.
- Dorst, J. and Dandelot, P. 1970. *A field guide to the larger mammals of Africa*. London: Collins.
- Duckworth, J. W. 1996a. Bird and mammal observations from the Sangthong District, Vientiane

- Municipality, Laos. *Nat. Hist. Bull. Siam Soc.* 44: 217-242.
- Duckworth, J. W. 1996b. *Conservation concerns in the Training and Model Forest, Sangthong District, Vientiane Municipality, Laos*. Second edition. Dong Dok, Laos: Lao-German Forestry Team.
- Duckworth, J. W. 1997. Small carnivores in Laos: a status review with notes on ecology, behaviour and conservation. *Small Carnivore Conserv.* 16: 1-21.
- Duckworth, J. W. in press. A survey of large mammals in the central Annamite mountains of Laos. *Z. Säugetierk.*
- Duckworth, W., Evans, T. and Timmins, R. 1993. *A wildlife and habitat survey of the Xe Pian National Biodiversity Conservation Area*. Vientiane: LSFCEP/IUCN.
- Duckworth, J. W., Timmins, R. J., Thewlis, R. C. M., Evans, T. D. and Anderson, G. Q. A. 1994. Field observations of mammals in Laos 1992-1993. *Nat. Hist. Bull. Siam Soc.* 42: 177-205.
- Duckworth, J. W., Timmins, R. J. and Evans, T. D. 1998. The conservation status of the River Lapwing *Vanellus duvaucelii* in southern Laos. *Biol. Conserv.* 84: 215-222.
- Dudley, J. P., Mensah-Nuamoah, A. Y. and Kpelle, D. G. 1992. Forest elephants in a rainforest fragment: preliminary findings from a wildlife conservation project in southern Ghana. *Afr. J. Ecol.* 30: 116-126.
- Durbin, J. C. and Ralambo, J. A. 1994. The role of local people in the successful maintenance of protected areas in Madagascar. *Env. Conserv.* 21: 115-120.
- Eames, J. C. and Nguyen Cu. 1994. *A management feasibility study of Thuong Da Nhim and Chu Yang Sin Nature Reserves on the Da Lat Plateau, Vietnam*. Hanoi: WWF Indochina Programme.
- Eames, J. C., Robson, C. R., Wolstencroft, J. A., Nguyen Cu and Truong Van La. 1988. *Vietnam Forest Project: pheasant surveys 1988*. Norwich, UK: unpubl. report.
- Eames, J. C., Robson, C. R., Nguyen Cu and Truong Van La. 1992. *Vietnam Forest Project: forest bird surveys 1991*. Cambridge, UK: ICBP (Study Report 51).
- Eames, J. C., Lambert, F. R. and Nguyen Cu. 1994. A survey of the Annamese lowlands, Vietnam, and its implications for the conservation of Vietnamese and Imperial Pheasants *Lophura hatinhensis* and *L. imperialis*. *Bird Conserv. Internat.* 4: 343-382.
- EIA [Environmental Investigation Agency]. 1996. *The political wilderness: India's Tiger crisis*. London and Washington: EIA.
- Eisenberg, J. F. and Seidensticker, J. 1976. Ungulates in southern Asia: a consideration of biomass estimates for selected habitats. *Biol. Conserv.* 10: 293-308.
- Emerson, B. 1997. *The natural resources and livelihoods study Ratanakiri Province, Cambodia*. Phnom Penh: Non-Timber Forests Project [funded by Oxfam and NOVIB].
- Evans, T., Stones, A. J. and Thewlis, R. C. M. 1996a. *A wildlife and habitat survey of the Phou Xiang Thong National Biodiversity Conservation Area*. Pakxe, Lao: IUCN.
- Evans, T., Stones, A. J. and Thewlis, R. C. M. 1996b. *A wildlife and habitat survey of the Dong Hua Sao National Biodiversity Conservation Area*. Pakxe, Lao: IUCN.
- Fernando, P. 1997. Keeping jumbo afloat: is translocation an answer to the human-elephant conflict? *Sri Lanka Nature* 1 (1): 4-12.
- Fernando, P. in prep. *WWF field survey of Nam Ghong Provincial Protected Area, Lao PDR*. Vientiane: WWF Indochina Programme.
- Foppes, J. 1995. *Farming and forest use systems survey and recommendations for community forestry in the Sang Thong training and model forest*. Dong Dok, Laos: Lao-German Forestry Team.
- Forbes, G. J. and Theberge, J. B. 1996. Response by Wolves to prey variation in central Ontario. *Canadian J. Zool.* 74: 1511-1520.
- FPD [Forest Protection Department] / FIPI [Forest Inventory and Planning Institute] / WWF [WorldWide Fund for Nature]. 1997. *Report assessment in biodiversity and possibility for the establishment of a nature reserves in the west of Quang Nam Province*. Hanoi: FPD / FIPI / WWF Indochina Programme.
- Franklin, N., Bastoni, Sriyanto, Siswomartono, D., Manansang, J. and Tilson, R. in press. Last of the Indonesian Tigers: a cause for optimism. In: Seidensticker, J., Christie, S. and Jackson, P. (eds.) *Riding the Tiger: Tiger conservation in human dominated landscapes*. Cambridge, UK:

- Cambridge University Press.
- Fuller, T. K. 1991. Do pellet counts index White-tailed Deer number and population change? *J. Wildl. Man.* 55: 393-396.
- Gadgil, M., Berkes, F. and Folke, C. 1993. Indigenous knowledge for biodiversity conservation. *Ambio* 22: 151-156.
- Ghazoul, J. and Le Mong Chan. 1994. *Site description and conservation evaluation: Nui Hoang Lien Nature Reserve, Lao Cai Province, Vietnam*. Hanoi: Frontier Vietnam (Technical Report 2).
- Gibson, C. C. and Marks, S. A. 1995. Transforming rural hunters into conservationists: an assessment of community-based wildlife management programs in Africa. *World Development* 23: 941-957.
- Green World Foundation 1997. *The mammal tracks of Thailand*. Bangkok: Green World.
- Groves, C. P., Schaller, G. B., Amato, G. and Khounboline, K. 1997. Rediscovery of the wild pig *Sus bucculentus*. *Nature* 386: 335.
- Grumbine, R. E. 1994. What is ecosystem management? *Conserv. Biol.* 8: 27-38.
- Hames, R. B. 1991. Wildlife conservation in tribal societies. Pp. 172-199 in Oldfield, M. L. and Alcorn, J. B. (eds) *Biodiversity: culture, conservation and ecodevelopment*. Boulder, USA: Westview.
- Hamilton, L. S., Mackay, J. C., Worboys, G. L., Jones, R. A. and Manson, G. B. (eds) 1996. *Transborder protected area cooperation*. Canberra: Australian Alps Liaison Committee / IUCN.
- Hansen, R. M. 1978. Use of dung pH to differentiate herbivore species. *J. Wildl. Man.* 42: 441-444.
- Haryono, M., Sugardjito, J., Pham Mong Giao, Vu Van Dung and Nguyen Xuan Dang. 1993. *Report of Javan Rhino survey in Vietnam*. Hanoi: WWF Indochina Programme.
- Hedges, S. in prep. *Asian wild cattle and buffaloes: status report and conservation action plan*. Gland, Switzerland: IUCN/SSC Asian Wild Cattle Specialist Group.
- Hedges, S. and Meijaard, E. in prep. Fallacies from faeces, or how not to count ungulates. (To be submitted to *J. Appl. Ecol.* in 1999.)
- Hedges, S. and Tyson, M. J. 1994. *Wildlife threatened and eco-tourism potential destroyed: the implications of the buffalo catching programme and the 'industrial' harvesting of Acacia nilotica seeds in Baluran National Park, East Java*. Preliminary report to the Directorate General of Forest Protection and Nature Conservation, Ministry of Forestry, Government of Indonesia, and the IUCN/SSC Asian Wild Cattle Specialist Group.
- Heng Kimchhay, Ouk Kimsan, Kry Masphal, Sin Polin, Uch Seiha and Weiler, H. 1998. *The distribution of Tiger, Leopard, elephant and wild cattle (Gaur, Banteng, buffalo, Khing Vor and Kouprey) in Cambodia*. Interim report. Phnom Penh: Wildlife Protection Office.
- Henning, D. H. 1994. *Report and recommendations for Lomphat Wildlife Sanctuary, Virachey National Park, and Ratanakiri Province*. Unpubl. typescript to the DNCP, Phnom Penh.
- Herrington, S. J. 1987. Subspecies and the conservation of *Panthera tigris*: preserving genetic heterogeneity. Pp. 51-61 in Tilson, R. L. and Seal, U. S. (eds) *Tigers of the world: the biology, biopolitics, management and conservation of an endangered species*. Park Ridge, New Jersey, USA: Noyes Publications.
- Heydon, M. J. and Bulloh, P. 1997. Mousedeer densities in a tropical rainforest: the impact of selective logging. *J. Appl. Ecol.* 34: 484-496.
- Hiby, L. and Lovell, P. 1991. DUNG SURV-a program for estimating elephant density from dung density without assuming 'steady state'. Pp. 73-80 in Ramakrishnan, U., Santosh, J. A. and Sukumar, R. (eds) *Proceedings of the workshop on censusing elephants in forests*. Bangalore, India: Asian Elephant Conservation Centre.
- Hile, M. E., Hintz, H. F. and Erb, H. N. 1997. Predicting body weight from measurements in Asian Elephants (*Elephas maximus*). *J. Zoo. Wildl. Med.* 28: 424-427.
- Hoang Hoe and Vo Quy. 1991. Nature Conservation in Vietnam: an overview. *Tigerpaper* 18 (4): 1-9.
- Hoang Quoc Truong. 1976. 'Rhinoceros and tapir'; article on p. 3 of the TP Ho Chi Minh City Liberty (Bao Giai phong) newspaper for 17 June 1976. [Not seen; cited in Tran Hong Viet 1990.]
- Hoffman, R. S. 1986. A new locality record for the Kouprey from Viet-Nam, and an archaeological

- record from China. *Mammalia* 50: 391-395.
- Hubback, T. R. 1937. The Malayan Gaur or Seladang. *J. Mammal.* 18: 267-279.
- Hurlbert, S. H. 1997. Functional importance vs keystone: reformulating some questions on theoretical biocenology. *Aust. J. Ecol.* 22: 369-382.
- ICF [International Crane Foundation]. 1996. *Preliminary report of a survey of Sarus Cranes and other wildlife in the Dong Khanhthung Area, Champasak Province, Lao PDR, August 1996.* Unpubl. typescript.
- Infield, M. 1988. *Hunting, trapping and fishing in villages within and on the periphery of the Korup National Park.* Cameroun: WWF (paper 6 of the Korup National Park socio-economic survey).
- IUCN. 1998. *Guidelines for re-introductions.* Gland, Switzerland and Cambridge, UK: IUCN Re-introduction Specialist Group.
- Jachmann, H. and Bell, R. H. V. 1979. The assessment of elephant numbers and occupancy by means of droppings counts in the Kasungu National Park, Malawi. *Afr. J. Ecol.* 17: 231-239.
- Jackson, P. 1997. The status of the Tiger in 1997. *Cat News* 27: 8-10.
- Ji Weizhi and Rabinowitz, A. 1995. *Proceedings for the workshop of trans-boundary biodiversity conservation in the eastern Himalayas.* Kunming, Yunnan, China: Kunming Institute of Zoology.
- Johnsingh, A. J. T. and Goyal, S. P. 1995. Vietnamese visit India. *Wildlife Institute of India Newsletter* 2 (3-4): 7-10.
- Johnsingh, A. J. T. and Nguyen Huu Dung. 1995. Conservation status of felids in Vietnam. *Cat News* 22: 16-18.
- Karanth, K. U. 1987. Tigers in India: a critical review of field censuses. Pp. 118-133 in Tilson, R. L. and Seal, U. S. (eds) *Tigers of the world: the biology, biopolitics, management and conservation of an endangered species.* Park Ridge, New Jersey, USA: Noyes Publications.
- Karanth, K. U. 1991. Ecology and management of the Tiger in tropical Asia. Pp. 156-159 in Maruyama, N., Bobek, B., Ono, Y., Reglin, W., Bartos, L. and Ratcliffe, R. (eds) *Wildlife conservation: present trends and perspectives for the 21st century.* Tokyo, Japan: Japan Wildlife Research Centre.
- Karanth, K. U. 1993. The relevance of big cat numbers to their conservation. *Cat News* 19: 11-12.
- Karanth, K. U. 1995. Estimating Tiger *Panthera tigris* populations from camera-trap data using capture-recapture models. *Biol. Conserv.* 71: 333-338.
- Karanth, K. U. 1997. Identification of camera-trapped Tigers. *Cat News* 26: 21-22.
- Karanth, K. U. 1998. Sacred groves for the 21st century. *Seminar* 466: 25-31.
- Karanth, K. U. in press a. Counting Tigers, with confidence. In: Seidensticker, J., Christie, S. and Jackson, P. (eds.) *Riding the Tiger: Tiger conservation in human dominated landscapes.* Cambridge, UK: Cambridge University Press.
- Karanth, K. U. in press b. Counting the Tiger's prey, reliably. In: Seidensticker, J., Christie, S. and Jackson, P. (eds.) *Riding the Tiger: Tiger conservation in human dominated landscapes.* Cambridge, UK: Cambridge University Press.
- Karanth, K. U. and Madhusudan, M. D. 1997. Avoiding paper Tigers and saving real Tigers: response to Sabervall. *Conserv. Biol.* 11: 818-820.
- Karanth, K. U. and Suth, B. M. in press. Importance of prey depletion in driving the Tiger's decline. In: Seidensticker, J., Christie, S. and Jackson, P. (eds.) *Riding the Tiger: Tiger conservation in human dominated landscapes.* Cambridge, UK: Cambridge University Press.
- Karanth, K. U. and Sunquist, M. E. 1992. Population structure, density and biomass of large herbivores in the tropical forests of Nagarhole, India. *J. Trop. Ecol.* 8: 21-35.
- Karanth, K. U. and Sunquist, M. E. 1995. Prey selection by Tiger, Leopard and Dhole in tropical forests. *J. Anim. Ecol.* 64: 439-450.
- Kemp, N. and Dilger, M. 1996. *Site description and conservation evaluation: Bu Huong Proposed Nature Reserve, Quy Chau District, Nghe An Province, Vietnam.* Hanoi: Frontier Vietnam (Scientific Report 7).
- Kemp, N., Le Mong Chan and Dilger, M. 1995. *Site description and conservation evaluation: Pu Mat Nature Reserve, Nghe An Province, Vietnam.* Hanoi: Frontier Vietnam (Scientific Report 5).
- Kendall, K. C., Metzgar, L. H., Patterson, D. A., and Steele, B. M. 1992. Power of sign surveys to monitor population trends. *Ecological Applications* 2: 422-430.

- Kitchener, A. C. in press. Tiger distribution, phenotypic variation and conservation issues. In: Seidensticker, J., Christie, S. and Jackson, P. (eds.) *Riding the Tiger: Tiger conservation in human dominated landscapes*. Cambridge, UK: Cambridge University Press.
- Knox, A. G. 1993. Richard Meinertzhagen: a case of fraud re-examined. *Ibis* 135: 320-325.
- Kohn, M. H. and Wayne, R. K. 1997. Facts from feces revisited. *TREE* 12: 223-227.
- Koster, S. H. and Hart, J. A. 1988. Methods of estimating ungulate populations in tropical forests. *Afr. J. Ecol.* 26: 117-126.
- Kottak, C. P. and Costa, A. C. G. 1993. Ecological awareness, environmentalist action and international conservation strategy. *Human Organisation* 52: 335-343.
- Kramer, R., van Schaik, C. and Johnson, J. 1997. *Last stand: protected areas and the defense of tropical biodiversity*. Oxford, UK: Oxford University Press.
- Kraushar, P. 1985. *Practical business development: what works and what does not*. London: Holt, Rinehart and Winston.
- Kremen, C., Merenlender, A. M. and Murphy, D. D. 1994. Ecological monitoring: a vital need for Integrated Conservation and Development Programs in the tropics. *Conserv. Biol.* 8: 388-397.
- Kumar, A. and Wright, B. in press. Tiger anti-poaching and anti-trade strategies for the Indian subcontinent. In: Seidensticker, J., Christie, S. and Jackson, P. (eds.) *Riding the Tiger: Tiger conservation in human dominated landscapes*. Cambridge, UK: Cambridge University Press.
- Kurt, F., Hartl, G. B. and Tiedmann, R. 1995. Tuskless bulls in the Asian Elephant *Elephas maximus*: history and population genetics of a man-made phenomenon. *Acta Theriol. Suppl.* 3: 125-143.
- Lahm, S. A. 1996. A nationwide status survey of crop raiding by elephants and other species in Gabon. *Pachyderm* 21: 69-77.
- Lair, R. C. 1997. *Gone astray: the care and management of the Asian Elephant in domesticity*. Bangkok: FAO (RAPA Publ. 1997/16).
- Lambeck, R. J. 1997. Focal species: a multi-species umbrella for nature conservation. *Conserv. Biol.* 11: 849-856.
- La-Ong, S., Pothieng, D. and Sakon, B. 1997. *Survey on wildlife trading at the frontier of Thailand-Cambodia and People's Republic of Laos*. Bangkok: WWF Thailand Project Office.
- Larson, P. S., Freudenberger, M. and Wyckoff-Baird, B. 1998. *WWF Integrated conservation and development projects: ten lessons from the field 1985-1996*. Washington DC: WWF-US.
- Laurie, A., Ha Dinh Duc and Pham Trong Anh. 1989. *Survey for Kouprey Bos sauveli in western Daklak Province, Vietnam*. Kouprey Conservation Trust.
- Lay Khim and Taylor-Hunt, D. 1995. *Kirirom General Survey*. Phnom Penh: Ministry of Environment and IDRC.
- Leader-Williams, N. and Albon, S. D. 1988. Allocation of resources for conservation. *Nature* 336: 533-535.
- Leader-Williams, N., Albon, S. D. and Berry, P. S. M. 1990. Illegal exploitation of Black Rhinoceros and elephant populations: patterns of decline, law enforcement and patrol effort in Luangwa Valley, Zambia. *J. Appl. Ecol.* 27: 1055-1087.
- Le Trong Trai. 1994. *Bao Cao Tai Nguyen Dong Vat Rung Vung Duyen Hai Trung Bo [Forest resources including plants and animals in the coastal provinces of central Vietnam]*. Hanoi: FIPI. [In Vietnamese.]
- Le Trong Trai and Pham Duc Tien. 1993. *Bao Cao Tai Nguyen Dong Vat Rung Tay Nguyen [Wildlife resources of Tay Nguyen]*. Hanoi: FIPI. [In Vietnamese.]
- Le Trong Trai, Nguyen Cu, Le Van Cham, Eames, J. C. and Tran Van Khoa. 1996a. *Nguyen cuu da dang sinh hoc va xem xet luan chung kha thi khu bao ton thien nhien Chu Yang Sin, Tinh Dac Lac [Biodiversity survey and feasibility study of Chu Yang Sin Nature Reserve]*. Hanoi: BirdLife International / FIPI.
- Le Trong Trai, Nguyen Huy Dung, Nguyen Cu, Le Van Cham and Eames, J. C. 1996b. *Du an kha thi khu bao ton thien nhien Ke Go [Feasibility study of Ke Go Nature Reserve]*. Hanoi: BirdLife International / FIPI.
- Le Vu Khoi. 1995. The status of wild cattle and their conservation in Vietnam. Pp. 121-131 in Byers, O., Hedges, S. and Seal, U. S., eds. *Asian wild cattle conservation assessment and management*

- plan workshop. Working document. Apple Valley, MN, USA: IUCN/SSC Conservation Breeding Specialist Group.
- Le Vu Khoi. n.d. *The status and conservation of Tiger in Vietnam*. Unpubl. typescript.
- Le Vu Khoi and Do Tuoc. 1992. The status of elephants and their conservation in Vietnam. Pp. 46-52 in Asian Elephant Conservation Centre (comp.), *Asian Elephant Specialist Group Meeting, Bogor, Indonesia, 20-22 May, 1992: proceedings*. Bangalore, India: AECC.
- Le Xuan Canh. 1995. *A report on the survey for large carnivores in Tay Nguyen Plateau, South Vietnam with emphasis on Tiger (Panthera tigris)*. Hanoi: unpubl. report to WCS.
- Le Xuan Canh, Truong Van La, Dang Thi Dap, Ho Thu Cuc, Ngo Anh Dao, Nguyen Ngoc Chinh, Vu Van Dung, Pham Nhat, Nguyen Thai Tu, Nguyen Quoc Thang and Tran Minh Hien. 1997a. *A report on field surveys on biodiversity in Phong Nha-Ke Bang Forest (Quang Binh Province) central Vietnam*. Hanoi: IEBR / FIPI / Forestry College / University of Vinh / WWF Indochina Programme.
- Le Xuan Canh, Pham Trong Anh, Duckworth, J. W., Vu Ngoc Thanh and Lic Vuthy. 1997b. *A survey of large mammals in Dak Lak Province, Vietnam*. Hanoi: WWF Indochina Programme / IUCN.
- Legendre, S. J. 1932. Adventures on hunting trails of Indo-china. *Natural History* 32: 481-496.
- Lekagul, B. 1952. On the trail of the Kouprey or Indo-Chinese Forest Ox (*Bibos sauveli*). *J. Bombay Nat. Hist. Soc.* 50: 623-628.
- Lekagul, B. and McNeely, J. A. 1977. *Mammals of Thailand*. Bangkok: Association for the Conservation of Wildlife.
- Leyhausen, P. 1986. What is a viable Tiger population? *Cat News* 4: 3-4.
- Lindeque, M. and van Jaarsveld, A. S. 1993. Post-natal growth of elephants *Loxodonta africana* in Etosha National Park, Namibia. *J. Zool.* 229: 319-330.
- Li Wenjun, Fuller, T. K. and Wang Sung. 1996. A survey of wildlife trade in Guangxi and Guangdong, China. *TRAFFIC Bull.* 16: 9-16.
- Lindzey, F. G., van Sickle, W. D., Laing, S. P. and Mecham, C. S. 1992. Cougar population response to manipulation in southern Utah. *Wildlife Soc. Bull.* 20: 224-227.
- Lindzey, F. G., Van Sickle, W. D., Ackerman, B. B., Barnhurst, D., Hemker, T. P. and Laing, S. P. 1994. Cougar population dynamics in southern Utah. *J. Wildl. Man.* 58: 619-624.
- Linnell, J. D. C., Aanes, R., Swenson, J. E., Odden, J. and Smith, M. E. 1997. Translocation of carnivores as a method for managing problem animals: a review. *Biodiv. Conserv.* 6: 1245-1257.
- Liu, D. S., Iverson, L. R. and Brown, S. 1993. Rates and patterns of deforestation in the Philippines: application of geographic information system analysis. *Forest Ecol. Management* 57: 1-16.
- Lu Houji. 1987. Habitat availability and prospects for Tigers in China. Pp. 71-74 in Tilson, R. L. and Seal, U. S. (eds) *Tigers of the world: the biology, biopolitics, management and conservation of an endangered species*. Park Ridge, New Jersey, USA: Noyes Publications.
- Ma Yiqing and Wang Yingxiang. 1995. One [sic] the wild cattle in China. Pp. 132-134 in Byers, O., Hedges, S. and Seal, U. S., eds. *Asian wild cattle conservation assessment and management plan workshop. Working document*. Apple Valley, MN, USA: IUCN/SSC Conservation Breeding Specialist Group.
- Ma Yiqing, Li Xiaomin and Sheng Helin. 1997. Status and conservation of Tigers in China. *Cat News* 26: 6-7.
- MacKinnon, J. and Stuart, S. N. 1988. *The Kouprey: an action plan for its conservation*. Gland, Switzerland: IUCN.
- MacKinnon, J. and Vu Van Dung. 1992. *Draft management plan for Vu Quang Nature Reserve, Vietnam*. WWF Project VN 005. Unpubl. report.
- MacLochlainn, C. 1995. Editor's letter. *Irish Wildbird Conservancy News* 82: 4.
- Mainka, S. A. 1997. *Tiger progress: the response to CITES Resolution conf. 9.13*. Cambridge, UK: TRAFFIC International.
- Mandujano, S. and Gallina, S. 1995. Comparison of deer censusing methods in tropical dry forest. *Wildl. Soc. Bull.* 23: 180-186.
- Margules, C. R. 1989. Introduction to some Australian developments in conservation evaluation. *Biol. Conserv.* 50: 1-11.

- Marsh, C. 1997a. *Report on a visit to Luang Namtha and Xishuangbanna Nature Reserve, China*. Vientiane: unpubl. report by LSFCP to Department of Forestry.
- Marsh, C. 1997b. *Field trip report No. 5: Phou Xang He NBCA, December 11-20, 1997*. Vientiane: unpubl. typescript to LSFCP.
- Martin, E. B. 1992a. The trade and uses of wildlife products in Laos. *TRAFFIC Bull.* 13: 23-28.
- Martin, E. B. 1992b. Observations on wildlife trade in Vietnam. *TRAFFIC Bull.* 13: 61-67.
- Martin, E. B. and Phipps, M. 1996. A review of wild animal trade in Cambodia. *TRAFFIC Bull.* 16: 45-60.
- Martin, E. B. and Phipps, M. 1997. Tigers in Cambodia. *Cat News* 26: 10.
- McGowan, P. and Gillman, M. 1997. Assessment of the conservation status of partridges and pheasants in South East Asia. *Biodiv. Conserv.* 6: 1321-1337.
- McNeely, J. A. 1975. *Draft report on wildlife and national parks in the lower Mekong basin*. Unpublished draft report.
- McNeely, J. A. and Miller, K. R. (eds) 1984. *National parks, conservation and development: the role of protected areas in sustaining society*. Washington DC: IUCN / Smithsonian Institution Press.
- MDYIZ [Mammalogical Division, Yunnan Institute of Zoology]. 1976. The distribution of wild elephants in Yunnan and their conservation. *Chinese J. Zool.* 2: 38-39.
- Meijaard, E. 1997. The Bay Cat in Borneo. *Cat News* 27: 21-23.
- Menon, V., Sukumar, R. and Kumar, A. 1997. *A god in distress: threats of poaching to the Asian Elephant in India*. Bangalore, India: Asian Elephant Conservation Centre.
- Mills, J. A. and Jackson, P. 1994. *Killed for a cure: a review of the worldwide trade in Tiger bone*. Cambridge, UK: TRAFFIC International.
- Ministry of Forestry / WWF. 1994. *Management plan and proposal for implementation of the Cat Tien National Park*. Hanoi: unpubl. report by MoF/WWF Indochina Programme.
- Minta, S. C. and Mangel, M. 1989. A simple population estimate based on simulation for capture-recapture and capture-resight data. *Ecology* 70: 1738-1751.
- Miquelle, D. G., Smirnov, E. N., Quigley, H. G., Hornocker, M. G., Nikolaev, I. G. and Matyushkin, E. N. 1996. Food habits of Amur Tigers in Sikhote-Alin Zapovednik and the Russian Far East, and implications for conservation. *J. Wildl. Res.* 1: 138-147.
- Mishra, H. R., Wemmer, C. and Smith, J. L. D. 1987. Tigers in Nepal: management conflicts with human interests. Pp. 449-463 in Tilson, R. L. and Seal, U. S. (eds) *Tigers of the world: the biology, biopolitics, management and conservation of an endangered species*. Park Ridge, New Jersey, USA: Noyes Publications.
- Mlikovsky, J. and Inskipp, T. P. in prep. *Annotated checklist and bibliography of the birds of Indochina*. Oriental Bird Club.
- Mooty, J. J., Karns, P. D., and Heisey, D. M. 1984. The relationship between White-tailed Deer track counts and pellet-group surveys. *J. Wildl. Man.* 48: 275-279.
- MPHVN [Map Publishing House of Vietnam] 1997. *Cong Hoa Xa Hoi Chu Nghia Viet Nam* (1 : 2,200,000 scale map). Hanoi: General Department of Geography.
- Nadler, T. 1996. Verbreitung und status von Delacour-, Tonkin- und Goldscopf-languren (*Trachypithecus delacouri*, *Trachypithecus francoisi* und *Trachypithecus poliocephalus*) in Vietnam. *Zool. Garten N. F.* 66: 1-12.
- Nash, S. V. 1997a. *Still in business: the ivory trade in Asia seven years after the CITES ban*. Cambridge, UK: TRAFFIC International.
- Nash, S. V. (ed.) 1997b. *Fin, feather, scale and skin: observations on the wildlife trade in Lao PDR and Vietnam*. Petaling Jaya, Malaysia: TRAFFIC Southeast Asia.
- Nath, C. D. and Sukumar, R. 1998. *Elephant-human conflict in Kodagu, Southern India: distribution patterns, people's perceptions and mitigation methods*. Bangalore, India: Asian Elephant Conservation Centre.
- Neal Thorn and Be Seng Leang. 1996. *Socio-economic and ecological survey in Snoul Wildlife Sanctuary*. Phnom Penh: Department of Nature Conservation and Protection, Ministry of the Environment.
- Neese, H. C. 1975. *Survival of the Javan Rhinoceros in Laos*. Unpubl. report to New York

- Zoological Society.
- Neff, D. J. 1968. The pellet-group count technique for big game trend, census, and distribution: a review. *J. Wildl. Man.* 32: 597-614.
- Ngo Viet Nhon. 1995. *Phieu tin tuc ve voi tai vuon uoc gia Bach Ma*. Unpubl. (cited in WWF/EC 1997).
- Ngoc Duc Manh. 1994. *Law on environmental protection*. Hanoi: National Political Publishing House / Science and Technics Publishing House.
- Nguyen Ba Thu. 1998. *A report on Tiger field survey in Quang Nam Province (from May 2 to May 20, 1998)*. Unpublished typescript.
- Nguyen Huu Dinh. 1962. *Rapport concernant la création du parc national de Bach Ma-Hai Van*. Bo cai tien nong thon nha lam vu khu lam vu lien tinh V. Unpubl. (cited in WWF/EC 1997).
- Nguyen Xuan Dang and Pham Trong Anh. 1991. New information on the Tiger in Vietnam. *Tiger Beat* 4 (2): 8-9.
- Noss, A. J. 1997. Challenges to nature conservation with community development in central African forests. *Oryx* 31: 180-188.
- Noss, A. J. in press. The impacts of cable snare hunting on wildlife populations in the forests of the Central African Republic. *Conserv. Biol.*
- Nouvellic, P. A. and Knight, M. 1994. Repatriation and translocation of ungulates into South African national parks: an assessment of past attempts. *Koedoe* 37 (1): 115-119.
- Nowell, K. and Jackson, P. 1996. *Wild cats: status survey and conservation action plan*. Gland, Switzerland: IUCN.
- Oates, J. F. 1995. The dangers of conservation by rural development-a case-study from the forests of Nigeria. *Oryx* 29: 115-122.
- O'Donoghue, M., Boutin, S., Krebs, C. J. and Hofer, E. J. 1997. Numerical responses of Coyotes and Lynx to the Snowshoe Hare cycle. *Oikos* 80: 150-162.
- Olivier, R. and Woodford, M. 1994. *Aerial surveys for Kouprey in Cambodia, March 1994*. Gland, Switzerland, and Cambridge, UK: IUCN/SSC.
- Osborn, F. V. and Rasmussen, L. E. L. 1995. Evidence for the effectiveness of an oleo-resin capsicum aerosol as a repellent against wild elephants in Zimbabwe. *Pachyderm* 20: 55-64.
- Osborn, F. V. and Welford, L. A. 1997. *Living with elephants: a manual for wildlife managers on the SADC region*. Malawi: Department of National Parks and Wildlife.
- Osgood, W. H. 1932. Mammals of the Kelley-Roosevelts and Delacour Asiatic expeditions. *Publ. Field Mus. Nat. Hist., Zool. Ser.* 18: 193-339.
- Owen, M. 1990. The damage conservation interface illustrated by geese. *Ibis* 132: 238-252.
- Paine, R. T. 1995. A conversation on refining the concept of keystone species. *Conserv. Biol.* 9: 962-964.
- Pal, B. C. and Guin, D. P. 1986. Population structure of Gaur herds at Garumara Wildlife Sanctuary, West Bengal, India. *Proc. Zool. Soc. Calcutta* 35: 89-95.
- Panwar, H. S. 1987. Project Tiger: the reserves, the Tigers and their future. Pp. 110-117 in Tilson, R. L. and Seal, U. S. (eds) *Tigers of the world: the biology, biopolitics, management and conservation of an endangered species*. Park Ridge, New Jersey, USA: Noyes Publications.
- Parker, I. S. C. and Graham, A. D. 1989. Men, elephants and competition. *Symp. Zool. Soc. London* 61: 241-252.
- Patte, E. 1928. Comparaison des faunes de mammifères de Lang Son (Tonkin) et du Se Tchouen. *Bull. Soc. Geol. France* (4) 28: 55-63.
- Payne, J., Bernazzani, P. and Duckworth, W. 1995. *A preliminary wildlife and habitat survey of Phou Khao Khouay National Biodiversity Conservation Area, Vientiane Prefecture, Vientiane Province and Bolikhamxai Province, Lao PDR*. Vientiane: CPAWM/WCS.
- Pfeffer, P. and Ou Kim San. 1967. Le Kouprey, *Bos (Bibos) sauveli* Urbain, 1937: discussion systématique et status actuel. Hypothèse sur l'origine du zebu (*Bos indicus*). *Mammalia* 31: 521-536.
- Pfeiffer, E. W. 1984. The conservation of nature in Vietnam. *Env. Conserv.* 11: 217-221.
- PFDPQN [Provincial Forest Protection Department of Quang Nam-Da Nang]. 1996. *Results of a preliminary survey on the Saola, Pseudoryx nghetinhensis, Quang Nam-Da Nang Province*.

- Unpubl. report.
- Pham Mong Giao, Nguyen Xuan Dang and Walston, J. 1997. *Report of a survey into human-elephant conflict at Tan Phu Forest Enterprise area, Dong Nai Province, Vietnam*. Hanoi: FFI.
- Pham Nhat, Do Tuoc and Truong Van La. 1995 (?). *A survey for Hatinh Langur (Trachypithecus francoisi hatinhensis) in the north central Vietnam*. Hanoi: unpubl. report to WWF Indochina Programme and Primate Conservation, Inc.
- Pham Trong Anh and Le Xuan Canh. 1996. *Survey on wildlife of Bu Gia Map forest, Song Be Province*. Hanoi: IEBR. Cited by Le Xuan Canh *et al.* 1997b, but no copy now traceable (Le Xuan Canh verbally 1998).
- Pham Trong Anh and Nguyen Xuan Dang. n/d (1994 or later). The status of Tiger (*Panthera tigris corbetti*) in Vietnam and recommendations for the Tiger Conservation Action Plan. Unpubl. typescript.
- Pham Trong Anh, Nguyen Dang Khoi and Nguyen Thi Tang Long. 1996. Checklist of mammal collection of Da Lat Biological Subinstitute. *Tap Chi Sinh Hoc [J. Biology, Hanoi]* 18 (1): 16-22. [In Vietnamese with English title and summary.]
- Phanthavong, B. and Dobias, B. 1993. *Draft management framework: Phou Xang He*. Vientiane: unpubl. typescript to LSFCP.
- Phanthavong, B. and Santiapillai, C. 1991. Status, distribution and conservation of wild cattle in Laos. *Asian Wild Cattle Spec. Grp Newsletter* 4: 3-15.
- Phanthavong, B. and Santiapillai, C. 1992. Conservation of elephants in Laos. *Asian Elephant Spec. Grp Newsletter* 8: 25-33.
- Phi Manh Hong and Dao Van Tien. 1988. List of mammals at present known in the Bavi reserve (Hanoi). *Tap Chi Sinh Hoc* 10 (2): 22-29. [In Vietnamese with English title and summary.]
- Phiapalath, P. 1996. *Luang Namtha community-based conservation project: village wildlife interview report February-June 1996*. Vientiane: unpubl. typescript to WCS.
- Plowden, C. and Bowles, D. 1997. The illegal market in Tiger parts in northern Sumatra, Indonesia. *Oryx* 31: 59-66.
- Policansky, D. 1986. North Pacific Halibut fishery management - case study. Pp. 138-150 in Orians, G. H. *et al.* (eds) *Ecological knowledge and environmental problem-solving*. Washington DC: National Academy Press.
- Poole, J. and Thomsen, J. B. 1989. Elephants are not beetles: implications of the ivory trade for the survival of the African Elephant. *Oryx* 23: 188-189.
- Putman, R. J. 1984. Facts from faeces. *Mammal Rev.* 14: 79-97.
- Quigley, H. B. and Crawshaw, P. G. 1992. A conservation plan for the Jaguar *Panthera onca* in the Pantanal region of Brazil. *Biol. Conserv.* 61: 149-157.
- Rabinowitz, A. 1989. The density and behavior of large cats in a dry tropical forest mosaic in Huai Kha Khaeng Wildlife Sanctuary, Thailand. *Nat. Hist. Bull. Siam Soc.* 37: 235-251.
- Rabinowitz, A. 1993. Estimating the Indochinese Tiger *Panthera tigris corbetti* population in Thailand. *Biol. Conserv.* 65: 213-217.
- Rabinowitz, A. 1994. First conference on trans-boundary biodiversity in the eastern Himalayas held in Kunming, China. *Nat. Hist. Bull. Siam Soc.* 42: 154-157.
- Rabinowitz, A. 1995a. Jaguar conflict and conservation: a strategy for the future. Pp. 394-397 in Bissonette, J. A. and Krausman, P. R. (eds) *Integrating people and wildlife for a sustainable future*. Bethesda MD, USA: The Wildlife Society.
- Rabinowitz, A. 1995b. Asian nations meet in Thailand to discuss trans-boundary biodiversity conservation. *Nat. Hist. Bull. Siam Soc.* 43: 23-26.
- Rabinowitz, A. 1995c. Helping a species go extinct: the Sumatran Rhino in Borneo. *Conserv. Biol.* 9: 482-488.
- Rabinowitz, A. in press. The status of the Tiger in Indochina: separating fact from fiction. In: Seidensticker, J., Christie, S. and Jackson, P. (eds.) *Riding the Tiger: Tiger conservation in human dominated landscapes*. Cambridge, UK: Cambridge University Press.
- Ratajszczak, R. 1988. Notes on the current status and conservation of primates in Vietnam. *Primate Conserv.* 9: 134-136.

- Reed, J. Z., Tollit, D. J., Thompson, P. M., and Amos, W. 1997. Molecular scatology: the use of molecular genetic analysis to assign species, sex and individual identity to seal faeces. *Molecular Ecol.* 6: 225-234.
- Reynolds, R. P., Crombie, R. I., McDiarmid, R. W. and Yates, T. L. 1996. Voucher specimens. Pp. 63-68 in Wilson, D. E., Cole, F. R., Nichols, J. D., Rudran, R. and Foster, M. S. (eds) *Measuring and monitoring biological diversity: standard methods for mammals*. Washington and London: Smithsonian Institution Press.
- Rheinart des Essarts, Baron de. 1934. *Souvenir de chasse*. Tap chi do thanh hieu co. (cited in WWF/EC 1997).
- Robichaud, W. and Sounthala, B. 1995. *A preliminary wildlife and habitat survey of Phou Dendin National Biodiversity Conservation Area, Phongsali*. Vientiane: CPAWM/Cedar Grove Ornithological Research Station Inc.
- Robinson, A. and Yem Sokhan. 1996. *Strategy for Ratanakiri Province conservation based on CEMP field assessment*. Phnom Penh: Cambodia Environmental Management Program.
- Robinson, J. G. 1993. The limits to caring: sustainable living and the loss of biodiversity. *Conserv. Biol.* 7: 20-28.
- Robinson, J. G. and Bennett, E. L. (eds) in press. *Hunting for sustainability in the tropical forests*. New York, USA: Columbia University Press.
- Rogers, L. L. 1987. Seasonal changes in defecation rates of free-ranging White-tailed Deer. *J. Wildl. Man.* 51: 330-333.
- Rollins, D., Bryant, F. C., and Montandon, R. 1984. Fecal pH and defecation rates of eight ruminants fed known diets. *J. Wildl. Man.* 48: 807-813.
- Round, P. D. and Vongkhamheng, C. 1998. *Wildlife, habitats and priorities for conservation in Dong Khanthung proposed National Biodiversity Conservation Area, Champasak Province, Lao PDR: interim report after the dry season survey*. Vientiane: WCS / CPAWM.
- Rozendaal, F. 1990. *Report on surveys in Hoang Lien Son, Lai Chau and Nghe Tin Provinces, Viet Nam*. Unpubl. typescript.
- Saberwal, V. K. 1997. Saving the Tiger: more money or less power? *Conserv. Biol.* 11: 815-817.
- Sagar, S. R. and Singh, L. A. K. 1990. Technique to distinguish tracks of Leopard and Tiger cub. *Indian Forester* 116: 214-219.
- Salter, R. E. 1991a. *Notes on reconnaissance surveys of proposed protected areas, 15-22 February 1991*. Vientiane: unpubl. report to LSFCP.
- Salter, R. E. 1991b. *Notes on a reconnaissance survey of the proposed Muang Hiam protected area, 5-10 March 1991*. Vientiane: unpubl. report to LSFCP.
- Salter, R. E. 1991c. *Notes on reconnaissance surveys of proposed protected areas, 26-31 March 1991*. Vientiane: unpubl. report to LSFCP.
- Salter, R. E. 1992a. *Notes on a reconnaissance survey of the proposed Phou Dene Dinh protected area (PPA 9), 5-12 March 1992, with a summary of information received on the proposed Nam Khang area (PPA 23)*. Vientiane: unpubl. report to LSFCP.
- Salter, R. E. 1992b. *Notes on reconnaissance surveys of proposed protected areas, 22-29 March 1991*. Vientiane: unpubl. report to LSFCP.
- Salter, R. E. (comp.) 1993a. *Wildlife in Lao PDR: a status report*. Vientiane: IUCN.
- Salter, R. E. 1993b. *Zoning and environmental management plan for Angkor: background report on wildlife*. IUCN.
- Salter, R. E. and Phanthavong, B. 1990. *Phou Khao Khouay Protected Area management plan*. Vientiane: LSFCP.
- Salter, R. E., Phanthavong, B., Sawathvong S., Souriyakan, S. and Louanglath, K. 1990. *An assessment of the current status of Kouprey and other wild cattle in southern Laos*. Vientiane: FRCP/LSFCP.
- Salter, R. E., Phanthavong, B. and Venevongphet. 1991. *Planning and development of a protected area system in Lao PDR: status report to mid-1991*. Vientiane: FRCP/LSFCP.
- Santiapillai, C. 1991a. Management of elephants in the Xishuangbanna Nature Reserve, P. R. China: a case study. *Tigerpaper* 18 (2): 1-5.
- Santiapillai, C. 1991b. Resolving elephant-human conflict in Xishuangbanna Nature Reserve.

- IUCN/SSC Asian Elephant Spec. Grp Newsletter 6: 22-23.
- Santiapillai, C. 1992. WWF-3194 China, Xishuangbanna Nature Reserve elephant consultancy: a technical report. Unpubl. typescript.
- Santiapillai, C. 1993a. Elephants under threat in Laos. *Gajah* 10: 10.
- Santiapillai, C. 1993b. News from Vietnam. *Gajah* 11: 47.
- Santiapillai, C., 1997. The Asian Elephant conservation: a global strategy. *Gajah* 18: 21-39.
- Santiapillai, C. and Jackson, P. 1990. *The Asian Elephant: an action plan for its conservation*. Gland, Switzerland: IUCN.
- Santiapillai, C. and Ramono, W. S. 1987. Tiger numbers and habitat evaluation in Indonesia. Pp. 85-91 in Tilson, R. L. and Seal, U. S. (eds) *Tigers of the world: the biology, biopolitics, management and conservation of an endangered species*. Park Ridge, New Jersey, USA: Noyes Publications.
- Santiapillai, C., Pham Mong Giao and Vu Van Dung. 1993. Conservation and management of Javan Rhino (*Rhinoceros sondaicus annamiticus*) in Vietnam. *Tigerpaper* 20 (4): 7-15.
- Santiapillai, C., Zhu Xiang, Dong Yong Hua and Shen Qin Zhong. 1994. Distribution of elephant in Xishuangbanna Dai Autonomous Prefecture, China. *Gajah* 12: 34-45.
- Sarrazin, F. and Barbault, R. 1996. Reintroduction: challenges and lessons for basic ecology. *TREE* 11: 474-478.
- Sayer, J. 1983a. *Nature conservation and national parks*. Final report. Vientiane: FAO.
- Sayer, J. 1983b. Nature conservation priorities in Laos. *Tigerpaper* 10 (3): 10-14.
- Schaller, G. B. 1967. *The deer and the Tiger: a study of wildlife in India*. Chicago, USA: Chicago University Press.
- Schaller, G. 1995. *A wildlife survey in the Annamite mountains of Laos, December 1994 and January 1995*. Vientiane: unpubl. report to WCS.
- Schaller, G. B. 1997a. *Preliminary mammal survey of two areas in Luang Namtha Province, Lao PDR, February 4-16, 1997*. Vientiane: unpubl. report to WCS.
- Schaller, G. B. 1997b. *A preliminary survey of large mammals in two areas of Attapeu Province, Laos, January 1997*. Vientiane: unpubl. report to WCS.
- Schaller, G. and Boonsou, 1996. *A preliminary survey of the northern Xe Sap region, Salavan Province, April 25-May 11, 1996*. Vientiane: unpubl. report to WCS.
- Schaller, G. B. and Rabinowitz, A. 1995. The Saola or spindlhorn bovid *Pseudoryx nghetinhensis* in Laos. *Oryx* 29: 107-114.
- Schaller, G. and Robichaud, W. 1996. *Field trip report: preliminary wildlife survey in Xieng Khouang Province, May 16-25, 1996*. Vientiane: unpubl. report to WCS.
- Schaller, G. B. and Vrba, E. S. 1996. Description of the Giant Muntjac (*Megamuntiacus vuquangensis*) in Laos. *J. Mamm.* 77: 675-683.
- Schaller, G. B., Nguyen Xuan Dang, Le Dinh Thuy and Vo Thanh Son. 1990. Javan Rhinoceros in Vietnam. *Oryx* 24: 77-80.
- Seidensticker, J. 1984. *Managing elephant depredation in agricultural and forestry projects*. Washington DC: World Bank (Tech. Paper 16).
- Seidensticker, J. 1986. Large carnivores and the consequences of habitat insularization: ecology and conservation of Tigers in Indonesia and Bangladesh. Pp. 1-43 in Miller, S. D. and Everett, D. D. (eds) *Cats of the world: biology, conservation and management*. Washington DC: National Wildlife Federation.
- Seidensticker, J. and McDougal, C. 1993. Tiger predatory behaviour, ecology and conservation. Pp. 105-125 in Dunstone, N. and Gorman, M. L. (eds) *Mammals as predators*. Oxford, UK: Clarendon Press.
- Seidensticker, J. and Suyono, I. 1980. *The Javan Tiger and the Meru-Betiri Reserve: a plan for management*. Gland, Switzerland: IUCN.
- Showler, D. A., Davidson, P., Vongkhamheng, C. and Salivong K. 1998a. *A wildlife and habitat survey of the southern border of Xe Sap NBCA and the Dakchung Plateau, Xe Kong Province, Lao PDR*. Vientiane: CPAWM/WCS.
- Showler, D. A., Davidson, P., Khounbolin, K. and Salivong K. 1998b. *A wildlife and habitat survey of Nam Xam NBCA, Houaphanh Province, Lao PDR*. Vientiane: CPAWM/WCS.

- Simberloff, D. 1987. The Spotted Owl fracas: mixing academic, applied, and political ecology. *Ecology* 68: 766-772.
- Simberloff, D. 1998. Flagships, umbrellas, and keystones: is single-species management passé in the landscape era? *Biol. Conserv.* 83: 247-257.
- Singh, S. 1996. Mobilizing grassroots support. Pp. 10-15 in WWF India *The Tiger call*. New Delhi: WWF India.
- Smallwood, K. S. and Fitzhugh, E. L. 1993. A rigorous technique for identifying individual Mountain Lions *Felis concolor* by their tracks. *Biol. Conserv.* 65: 51-59.
- Smallwood, K. S. and Fitzhugh, E. L. 1995. A track count for estimating Mountain Lion *Felis concolor californica* population trend. *Biol. Conserv.* 71: 251-259.
- Smith, J. L. D., Wemmer, C. and Mishra, H. R. 1987. A Tiger geographic information system: the first step in a global conservation strategy. Pp. 464-474 in Tilson, R. L. and Seal, U. S. (eds) *Tigers of the world: the biology, biopolitics, management and conservation of an endangered species*. Park Ridge, New Jersey, USA: Noyes Publications.
- Sokolov, V. E. and Kuznetsov, G. V. n/d. *New data on Tiger ecology in south-eastern Asia*. Unpubl. typescript.
- Southgate, D. and Clark, H. L. 1993. Can conservation projects save biodiversity in South America? *Ambio* 22: 163-166.
- Srikosamatara, S. 1993. Density and biomass of large herbivores and other mammals in a dry tropical forest, western Thailand. *J. Trop. Ecol.* 9: 33-43.
- Srikosamatara, S., Siripholdej, B. and Suteethorn, V. 1992. Wildlife trade in Lao PDR and between Lao PDR and Thailand. *Nat. Hist. Bull. Siam Soc.* 40: 1-47.
- Srikosamatara, S. and Suteethorn, V. 1994. Wildlife conservation along the Thai-Lao border. *Nat. Hist. Bull. Siam Soc.* 42: 3-21.
- Srikosamatara, S. and Suteethorn, V. 1995. Populations of Gaur and Banteng and their management in Thailand. *Nat. Hist. Bull. Siam Soc.* 43: 55-83.
- Stearman, A. M. 1992. Neotropical indigenous hunters and their neighbors: Siriono, Chimane and Yuqui hunting on the Bolivian frontier. Pp. 108-130 in Redford, K. H. and Padoch, C. (eds) *Conservation of neotropical forests: working from traditional resource use*. Chicago: Chicago University Press.
- Steinmetz, R. 1998a. *A survey of habitats and mammals in Dong Phou Vieng National Biodiversity Conservation Area, Savannakhet Province, Lao PDR*. Bangkok: WWF Thailand Project Office (draft).
- Steinmetz, R. 1998b. *A participatory biodiversity assessment of Khammouan Limestone National Biodiversity Conservation Area, Khammouan Province, Lao PDR*. Bangkok: WWF Thailand Project Office (draft).
- Steinmetz, R. and Baird, I. 1997. *Participatory biodiversity assessment of Dong Phou Vieng Protected Area, Savanakheth Province, Lao PDR*. Bangkok: WWF Thailand Project Office (draft).
- Sugardjito, J., Haryono, M., Pham Mong Giao, Vu Van Dung and Nguyen Xuan Dang. 1993. *Management plan of Cat-Loc Nature Reserve*. unpubl. draft.
- Sukumar, R. 1989. *The Asian Elephant: ecology and management*. Cambridge, UK: Cambridge University Press.
- Sukumar, R. 1990. Ecology of the Asian Elephant in southern India, II. Feeding habits and crop-raiding patterns. *J. Trop. Ecol.* 6: 33-53.
- Sukumar, R. 1991. The management of large mammals in relation to male strategies and conflict with people. *Biol. Conserv.* 55: 93-102.
- Sukumar, R. 1993. Minimum viable populations for elephant conservation. *Gajah* 11: 48-52.
- Sukumar, R. and Gadgil, M. 1988. Male-female differences in foraging on crops by Asian Elephants. *Anim. Behav.* 36: 1233-1235.
- Sun Hean. 1995a. [Report on Kouprey research in Mondulkiri]. Phnom Penh: unpubl. report to the Chief of the Department of Forestry and Wildlife by the Wildlife Protection Office. [In Khmer.]
- Sun Hean. 1995b. An up-date on the status of the elephant in Cambodia. Pp. 7-8 in AESG, *A report on the AESG's mission to Cambodia to formulate a joint programme with the Department of*

- Forestry for the conservation of elephants in Cambodia*. Unpubl. report by the Asian Elephant Specialist Group.
- Sunquist, M. 1981. The social organization of Tigers in Royal Chitwan National Park, Nepal. *Smithsonian Contrib. Zool.* 336: 1-98.
- Tan Bangjie. 1985. Tigers in China. *Cat News* 3: 9-10.
- Thapar, V. 1996. The figure of one. Pp. 38-43 in WWF India *The Tiger call*. New Delhi: WWF India.
- Thewlis, R. M., Timmins, R. J., Evans, T. D. and Duckworth, J. W. in press. The conservation status of bird in Laos: a review of key species. *Bird Conserv. Internat.* 8 (Suppl.)
- Thompson, I. D., Davidson, I. J., O'Donel, S., and Brazeau, F. 1989. Use of track transects to measure the relative occurrence of some boreal mammals in uncut forest and regeneration stands. *Canadian J. Zool.* 67: 1816-1823.
- Thornback, J. 1984. *Wild cattle, bison and buffaloes: their status and potential value*. Cambridge, UK: IUCN.
- Thouless, C. 1987. Kampuchean wildlife: survival against the odds. *Oryx* 21: 223-228.
- Thouless, C. R. 1994. Conflict between humans and elephants on private land in north Kenya. *Oryx* 28: 119-127.
- Thouless, C. R. and Sakwa, J. 1995. Shocking elephants: fences and crop raiders in Laikipia District, Kenya. *Biol. Conserv.* 72: 99-107.
- Tilson, R. and Nyhaus, P. 1998. Keeping problem Tigers from becoming a problem species. *Conserv. Biol.* 12: 261-262.
- Timmins, R. J. 1997. *Notes on wildlife and habitats in Khammouan Limestone National Biodiversity Conservation Area, Khammouan Province, Lao PDR*. Vientiane: CPAWM/WCS.
- Timmins, R. J. in prep. *A wildlife survey of wetlands and rivers in Ratanakiri and eastern Stung Treng Provinces, northeastern Cambodia*. Hanoi: FFI.
- Timmins, R. J. and Bleisch, W. V. 1995. *A wildlife and habitat survey of Xe Bang Nouan National Biodiversity Conservation Area, Savannakhet and Salavan Provinces, Lao PDR*. Vientiane: CPAWM/WCS.
- Timmins, R. J. and Evans, T. D. 1996. *A wildlife and habitat survey of Nakai-Nam Theun National Biodiversity Conservation Area, Khammouan and Bolikhamxai Provinces, Lao PDR*. Vientiane: CPAWM/WCS.
- Timmins, R. J. and Khounboline, K. 1996. *A preliminary wildlife and habitat survey of Hin Namno National Biodiversity Conservation Area, Khammouan Province, Lao PDR*. Vientiane: CPAWM/WCS.
- Timmins, R. J. and Vongkhamheng, C. 1996a. *A preliminary wildlife and habitat survey of Xe Sap National Biodiversity Conservation Area and mountains to the south, Saravan Province, Lao PDR*. Vientiane: CPAWM/WCS.
- Timmins, R. J. and Vongkhamheng, C. 1996b. *A preliminary wildlife and habitat survey of the Dong Khanthung Area, Champasak Province, Lao PDR*. Vientiane: CPAWM/WCS.
- Timmins, R. J., Evans, T. D., Khounboline, K. and Sisomphone, C. 1998. Status and conservation of the Giant Muntjac *Megamuntiacus vuquangensis*, and notes on other muntjac species in Laos. *Oryx* 32: 59-67.
- Tizard, R. J. 1996. *A preliminary wildlife and habitat survey of the proposed northern extension to the Nakai-Nam Theun National Biodiversity Conservation Area and adjacent Nam Gnouang area, Lao PDR*. Vientiane: CPAWM/WCS.
- Tizard, R. J., Davidson, P., Khounboline, K. and Salivong, K. 1997. *A wildlife and habitat survey of Nam Ha and Nam Kong Protected Areas, Luang Namtha Province, Lao PDR*. Vientiane: CPAWM/WCS.
- Tobias, J. 1997. *Environmental and social action plan for the Nakai-Nam Theun catchment and corridor areas: report of the wildlife survey*. Vientiane: unpubl. WCS report to IUCN.
- Tordoff, A., Suihua, H. and Sobey, R. 1997. *Ben En National Park biodiversity survey 1997. Preliminary Report*. Hanoi: Frontier Vietnam (Technical Report 10).
- Toyne, P. and Hoyle, D. 1998. *Tiger status report*. Godalming, UK: WWF UK.

- Tran Hong Viet. 1988. The importance of wild animals in Sathay District Gialai-Kontum Province. *Tap Chi Sinh Hoc [J. Biol., Hanoi]* 10 (3-4): 36-38. [In Vietnamese with English title and summary.]
- Tran Hong Viet. 1990. Danh sach loai thu Tinh Gia Lai-Kon Tum [Mammal list for Gia Lai-Kon Tum Province]. *Tap Chi Sinh Hoc [J. Biol., Hanoi]* 13 (2): 16-22. [In Vietnamese.]
- Trinh Viet Cuong. in prep. *Domesticated elephants in Dak Lak Province, Vietnam*. Hanoi: FFI.
- UKM [University Kebangsaan Malaysia]. 1990. *Environmental post-project evaluation of Kenyir Dam, Terengganu, Peninsula Malaysia*. Unpublished report to Overseas Economic Cooperation Fund, Government of Japan.
- UNDP [United Nations Development Programme]. 1995. *Social policies and development: strategy and action plan for UNDP Vietnam*. Hanoi: UNDP.
- Usher, A. D. 1996. Damming the Theun river: Nordic companies in Laos. *The Ecologist* 26 (3): 85-92.
- van Dyke, F. G., Brocke, R. H. and Shaw, H. G. 1986. Use of road track counts as indices of Mountain Lion presence. *J. Wildl. Man.* 50: 102-109.
- van Sickle, W. D. and Lindzey, F. G. 1991. Evaluation of a Cougar population estimator based on probability sampling. *J. Wildl. Man.* 55: 738-743.
- van Strien, N. J. 1998. *Results of the 1998 Cat Loc Rhino census, Vietnam*. Report to the International Rhino Foundation.
- Varman, K. S. and Sukumar, R. 1995. A line transect method for estimating densities of large mammals in a tropical deciduous forest: an evaluation of models and field experiments. *J. Biosci.* 20: 273-287.
- Varman, K. S., Ramakrishnan, U., and Sukumar, R. no date. *Direct and indirect methods of counting elephants: a comparison of results from Mudumalai Sanctuary*. Unpublished manuscript.
- Venevongphet. 1992. Report on elephants in Laos. Pp. 53-55 in Asian Elephant Conservation Centre (comp.), *Asian Elephant Specialist Group Meeting, Bogor, Indonesia, 20-22 May, 1992: proceedings*. Bangalore, India: AECC.
- Vickery, J. A., Watkinson, A. R. and Sutherland, W. J. 1994. The solutions to the Brent Goose problem: an economic analysis. *J. Appl. Ecol.* 31: 371-382.
- Vo Than Son. 1991. *Human impact on the last surviving Javan Rhinoceros population in Vietnam and proposed conservation measures*. Hawaii: Environment and Policy Institute, East-West Center.
- von Clausewitz, C. 1976. *On war* (translated and edited from the 1832 original by Howard, M. and Paret, P.). Princeton, USA: Princeton University Press.
- Vu Van Dung, Nguyen Ngoc Chinh, Ebregt, A. and Santiapillai, C. 1995. The status of the newly-described large mammal, the long-horned bovid, in Vietnam. *Tigerpaper* 22: 3-19.
- Walston, J. (ed.) in prep. *A wildlife and habitat survey of Hin Namno National Biodiversity Conservation Area and surroundings, Lao PDR*. Hanoi: WWF Indochina Programme / WCS Lao Program.
- Walston, J., Do Tuoc and Trinh Viet Cuong. 1996. *Assessment of human / elephant conflict in Vietnam: Nghe An Province*. Hanoi: FFI/Ministry of Agriculture and Rural Development.
- Walston, J., Trinh Viet Cuong and Do Tuoc. 1997. *The status of the Asian Elephant in Quang Nam Province*. Hanoi: FFI.
- Wang Yingxiang. 1987. Mammals in Xishuang Bann area and a brief survey of its fauna. Pp. 289-310 in Xue Yongchun (ed.) *Report of expedition to Xichuangbanna Nature Reserve*. Kunming: Yunnan Science and Technology Press. [In Chinese with English abstract and title.]
- Weber, W. and Rabinowitz, A. 1996. A global perspective on large carnivore conservation. *Conserv. Biol.* 10: 1046-1054.
- Weiler, H. 1998a. *Virochey National Park expedition 17 February-25 February 1998*. Phnom Penh: Kouprey Reconnaissance Project.
- Weiler, H. 1998b. *A wildlife reconnaissance of the Phnom Voene area: Stung Treng and Ratanakiri boundary*. Phnom Penh: Kouprey Reconnaissance Project.
- Wells, M. P. and Brandon, K. E. 1993. The principles and practice of buffer zones and local participation in biodiversity conservation. *Ambio* 22: 157-162.

- Wemmer, C., Smith, J. L. D. and Mishra, H. 1987. Tigers in the wild: the biopolitical challenges. Pp. 396-405 in Tilson, R. L. and Seal, U. S. (eds) *Tigers of the world: the biology, biopolitics, management and conservation of an endangered species*. Park Ridge, New Jersey, USA: Noyes Publications.
- Wemmer, C., Kunz, T. H., Lundie-Jenkins, G. and McShea, W. J. 1996. Mammalian sign. Pp. 157-176 in Wilson, D. E., Cole, F. R., Nichols, J. D., Rudran, R. and Foster, M. S. (eds) *Measuring and monitoring biological diversity: standard methods for mammals*. Washington and London: Smithsonian Institution Press.
- Wharton, C. H. 1957. *An ecological study of the Kouprey, Novibos sauveli (Urbain)*. Manila: Institute of Science and Technology.
- Wharton, C. H. 1968. Man, fire and wild cattle in South-East Asia. *Proc. Ann. Tall Timbers Fire Ecology Conference* 8: 107-167.
- White, L. J. T. 1995. Factors affecting the duration of elephant dung piles in rain forest in Lope Reserve, Gabon. *Afr. J. Ecol.* 33: 142-150.
- Wikramanayake, E. D. 1998. *Tigers in Virachey National Park, Ratanakiri Province, Cambodia: poaching and trade*. Hanoi: WWF Indochina Programme.
- Wikramanayake, E. D. and Dillon, T. C. 1997. *A preliminary resource assessment of the Cambodia-Vietnam-Laos Tri-State area for ecoregion-based conservation planning*. Hanoi: WWF Indochina Programme.
- Wikramanayake, E. D., Dinerstein, E., Robinson, J. G., Karanth, U., Rabinowitz, A., Olson, D., Mathew, T., Hedao, P., Connor, M., Hemley, G. and Bolze, D. 1997. An ecology-based method for defining priorities for large mammal conservation: the Tiger as a case study. *Conserv. Biol.* 12: 865-878.
- Wildlife Conservation Society. 1995a. *Reconnaissance management survey of Phou Loewy and Nam Et National Biodiversity Conservation Areas*. Vientiane: WCS.
- Wildlife Conservation Society. 1995b. *A wildlife and habitat assessment of the Theun-Hinboun hydropower project area*. Vientiane: unpubl. WCS report to the Hydropower Office of the Lao PDR Ministry of Industry and Handicrafts and to Norplan A/S.
- Wildlife Conservation Society. 1995c. *A preliminary wildlife and habitat assessment of the Nam Theun 2 hydropower project area*. Vientiane: unpubl. WCS report to the Committee for Planning and Cooperation of the government of Lao PDR and the Project Development Group of the Nam Theun 2 Hydropower Project.
- Wildlife Conservation Society. 1995d. *A survey of terrestrial wildlife in the area to be affected by the proposed Xe Nam Noy-Xe Pian hydroelectric project*. Vientiane: WCS report to the Committee for Planning and Cooperation of the government of Lao PDR and Electrowatt Engineering Services.
- Wildlife Conservation Society. 1995e. *Preliminary management plan for Nakai Nam Theun National Biodiversity Conservation Area*. Vientiane: unpubl. WCS report to the Committee for Planning and Cooperation of the government of Lao PDR and the Project Development Group of the Nam Theun 2 Hydropower Project.
- Wildlife Conservation Society. 1996a. *Survey of nocturnal mammals in and near the Nakai-Nam Theun National Biodiversity Conservation Area, central Lao PDR, with notes on other wildlife observed and recommendations for management of the area*. Vientiane: unpubl. WCS report.
- Wildlife Conservation Society. 1996b. *Additional surveys and recommendations on the birds and mammals for the Nam Theun II hydropower project, with emphasis on the proposed corridor and reservoir islands areas*. Vientiane: unpubl. WCS report.
- Wiles, G. J. 1980. Faeces deterioration rates of four wild ungulates in Thailand. *Nat. Hist. Bull. Siam Soc.* 28: 121-134.
- Williams, A. C. and Johnsingh, A. J. T. 1997. *A status survey of elephants (Elephas maximus), their habitats and an assessment of the elephant-human conflict in Garo Hills, Meghalaya*. Dehradun, India: Wildlife Institute of India.
- Wolstencroft, J. in prep. *An assessment of the wildlife conservation value of the Dong Khanthung proposed NBCA in southwesternmost Lao PDR*.

- Wu Zhaolu. 1997. Application of participatory rural appraisal (PRA) method in the study of species and landscape variations. *Chin. J. Appl. Ecol.* 8 (suppl.): 89-94. (In Chinese with English abstract and title.)
- Wu Zhaolu and Peng Mingchun. 1997. Settlement patterns in Mengyang Nature Reserve of Xishuangbanna II: causes and effects. *Chin. J. Appl. Ecol.* 8 (suppl.): 25-31. (In Chinese with English abstract and title.)
- WWF [WorldWide Fund for Nature]/Burapha. 1997. *Rapid and participatory biodiversity assessments (BIORAP) in Xe-Piane NBCA*. WWF Thailand Project Office / Burapha Development Consultants.
- WWF/EC [European Commission] 1997. *Proposed second revision of the Bach Ma National Park management plan*. Unpubl. typescript.
- Yang Dehua and Zhang Cunjie. 1987. Quantitative distribution and protection of rare animals in Xishuangbanna. Pp. 311-325 in Xue Yongchun (ed.) *Report of expedition to Xichuangbanna Nature Reserve*. Kunming: Yunnan Science and Technology Press. [In Chinese with English abstract and title.]
- Yok Don National Park. 1998. *Phuong An Quy Hoach Mo Rong Vuon Quoc Gia Yokdon [Plan for the extension of Yok Don National Park]*. Unpublished.
- Yuang Yuan-Chang. 1992. The status of Asian Elephant in Yunnan Province, China. Pp. 58-59 in Asian Elephant Conservation Centre (comp.), *Asian Elephant Specialist Group Meeting, Bogor, Indonesia, 20-22 May, 1992: proceedings*. Bangalore, India: AECC.
- Zielinski, W. J. and Truex, R. L. 1995. Distinguishing tracks of Marten and Fisher at track-plate stations. *J. Wildl. Man.* 59: 571-579.

ANNEXES 1-4: SPECIES SITE ACCOUNTS

Sites are arranged in a roughly north-south order within each country; minor re-arrangement is made where desirable to place certain sites adjacent to each other. Sites where co-ordinates are not available or where they were found only late in the process may be out of sequence (often at the end of the country accounts).

Co-ordinates for Lao NBCAs are taken from Berkmüller *et al.* (1995a). Co-ordinates for Vietnamese protected areas are taken from an unpublished list supplied by the Forest Protection Department, Hanoi. Other co-ordinates have been derived by inspection of maps and should not be taken as definitive. Where co-ordinates are presented as a range, the median has been taken for positioning the site on Figs 1-4; adjustment has been made for some (of irregular or thin shapes) so that the symbol falls within the area's boundaries.

Key to abbreviations in Annexes 1-4

Tiger Conservation Unit: refers to the classification of Dinerstein *et al.* (1997); readers should refer to this document for location and other details of each TCU.

Level of evidence:

confirmed: acceptable record of species's presence.

extinct?: species appears to occur no longer at the site although evidence suggests that it did so formally.

provisional: report needing confirmation.

Class of evidence:

report: report from non-biologist.

news: media report.

footprints: footprints observed.

scrapes: scrapes observed.

feeding damage: feeding damage observed.

dung: faeces found in the field.

unspecified signs: unspecified signs observed.

remains in field: remains of one or more dead animals found in the field.

remains in village: remains of one or more dead animals, or live captive found, in a village or other location where animal's origin can only be established by discussion with people.

remains (location?): remains found in unspecified location.

heard: live animals heard in field.

seen: live animals seen in field and identity established.

unspecified direct contact: unspecified direct field contact.

not specified: class of evidence not specified.

photo (with one of above): record is supported by photograph.

The evidence needs this detail in presentation because two factors affect the credibility which can be attached to it: whether the identification is certain, and whether the location is certain.

Last positive information:

The year when the species was last confirmed to occur at the site is given. In a few cases a year is cited for a record which is still considered provisional: the year is marked with a question mark (?).

Annex 1: Tiger records from Indochina

Sites are shown on Fig. 1, numbered as in the text.

Vietnam

Site: 1, **Phong Quang**, Vi Quyen District, Ha Giang Province

Locator: ca. 23°00'N, 104°00'E

Tiger Conservation Unit No: none

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. Listed as present in the park by Nowell and Jackson (1996) based on Nguyen Xuan Dang and Pham Trong Anh (1991). However, at 70 sq. km in size, the reserve is unlikely to maintain a significant population of Tigers.

Site: 2, **Nui Pia Oac**, Nguyen Binh District, Cao Bang Province

Locator: ca. 22°36'N, 105°49'E

Tiger Conservation Unit No: none

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. Listed as present by Nowell and Jackson (1996) based on Nguyen Xuan Dang and Pham Trong Anh (1991). However at only 100 sq. km in size, the park seems unlikely to maintain a viable population of Tigers.

Site: 3, **Ba Be**, Ba Be District, Bac Kan Province

Locator: ca. 22°30'N, 105°36'E

Tiger Conservation Unit No: none

Protection status: National Park

Level of evidence: extinct?

Class of evidence: report

Last positive information: 1967

Notes. Reported in 1967 by Dao Van Tien (Pham Trong Anh and Nguyen Xuan Dang n/d); certainly no longer present (Do Tuoc verbally 1998).

Site: 4, **Tat Ke-Ban Bung**, Na Hang District, Tuyen Quang Province

Locator: 22°16-31'N, 105°22-29'E

Tiger Conservation Unit No: none

Protection status: Nature Reserve

Level of evidence: extinct?

Class of evidence: report

Last positive information: unknown

Notes. Although recorded from the site in a species list derived partly from literature review to 1993, the species was not recorded during extensive fieldwork in 1993-1994 (Cox 1994) and Do Tuoc (verbally 1998) doubts that the species persists there. Anomalously, Dang Huy Huynh *et al.* (1995b) mentioned that the species was subject to heavy hunting pressure and was therefore only rarely seen by 1995.

Site: 5, **Na Ri / Bach Thong** Districts, Bac Kan Province

Locator: ca. 22°10'N, 105°50'E

Tiger Conservation Unit No: none

Status and conservation of very large mammals in Indochina

Protection status: probably none

Level of evidence: extinct?

Class of evidence: news

Last positive information: 1989

Notes. A Tiger was reported in July 1984 (Le Vu Khoi verbally 1998) and one was killed in 1989 (Ha Dinh Duc verbally 1997), but it is unlikely the species is still present (Do Tuoc verbally 1998). A further report may refer to the same animal: one was shot when preying on stock from a site known as Dinh Hoa; the Tien Phong paper presented a photograph of the animal (Pham Trong Anh and Nguyen Xuan Dang n/d). Apparently there used to be a reserve in the area but after becoming badly degraded it was deleted from the Forest Protection Department's list (Do Quang Tung verbally 1998). The distance from the Kim Hy Nature Reserve (Bach Thonh District) is unclear.

Site: 6, **Day Hoang Lien**, Sa Pa / Binh Lu Districts, Lao Cai / Lai Chau Provinces

Locator: ca. 22°09'N, 103°45'E

Tiger Conservation Unit No: 90

Protection status: Nature Reserve

Level of evidence: extinct?

Class of evidence: report

Last positive information: unknown

Notes. In April 1993, a Tiger was killed by a mine in Than Uyen District, but it is unclear how close this was to the protected area (Pham Nhat *in litt.* 1998). Village reports in early 1994 suggest that Tigers are extinct as no recent sightings were traced (Ghazoul and Le Mong Chan 1994).

Site: 7, **Muong Nhe**, Muong Te / Muong Lay Districts, Lai Chau Province

Locator: 22°00-26'N, 102°10-45'E

Tiger Conservation Unit No: none

Protection status: Nature Reserve

Level of evidence: confirmed

Class of evidence: footprints, dung

Last positive information: 1994

Notes. A skeleton was collected in 1963 (Pham Trong Anh and Nguyen Xuan Dang n/d). During 1971-1975, the pharmacy of Muong Te District bought 6-7 skeletons of Tigers per year (Do Tuoc *et al.* 1994). Recorded on three visits in the mid-1970s (Cox *et al.* 1992b). One of few strongholds; a 1980 survey identified six animals at six boundary communes (Do Tuoc *et al.* 1994). As recently as late 1991 Tiger numbers seemed still to be high: fresh tracks were found twice, old tracks once and reports were received of two women being killed by Tigers and three Tigers being killed by people (one shot, two with baited mines) in July-August 1991. Localities were scattered throughout the reserve area (Cox *et al.* 1992b). In 1994 fresh tracks were seen and the population was estimated to be 15 (Do Tuoc *et al.* 1994). However, problems facing the reserve as a Tiger reserve are acute (not least because many people live within it) and at best 8-10 remained in 1997 (Do Tuoc and Le Trong Trai *in prep.*).

Site: 8, **Muong Phang**, Dien Bien District, Lai Chau Province

Locator: ca. 21°25'N, 103°09'E

Tiger Conservation Unit No: none

Protection status: Protected Landscape

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. Listed as present in the park by Nowell and Jackson (1996) based on Nguyen Xuan Dang and Pham Trong Anh (1991); however at under 10 sq. km it is clear the protected area cannot support significant numbers of Tigers.

Site: 9, **Bac Ninh / Bac Giang** Provinces

Locator: ca. 21°15'N, 106°30'E

Tiger Conservation Unit No: none

Protection status: not known

Level of evidence: extinct?

Class of evidence: unspecified direct contact

Last positive information: 1969

Notes. Encountered in the then Ha Bac Province in 1969 (Pham Trong Anh and Nguyen Xuan Dang n/d), but no longer present (Do Tuoc verbally 1998).

Site: 10, **Ba Vi**, Ba Vi District, Ha Tay Province

Locator: ca. 21°01'N, 105°22'E

Tiger Conservation Unit No: none

Protection status: National Park

Level of evidence: extinct?

Class of evidence: not specified

Last positive information: unknown

Notes. Tiger is included on a list (separate from the annotated main list) in Phi Manh Hong and Dao Van Tien (1988), but has not occurred in the area for many years (Do Tuoc verbally 1998).

Site: 11, **Sop Cop**, Song Ma District, Son La Province

Locator: ca. 20°41'N, 103°42'E

Tiger Conservation Unit No: none

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Villagers from Ban Houay Ha, near Nam Et NBCA, Lao, claimed that relatives of theirs just over the border in Vietnam shot three Tigers in January 1998; this might refer to an area just south of Sop Cop (Showler *et al.* 1998b).

Site: 12, **Xuan Nha**, Moc Chau District, Son La Province

Locator: ca. 20°41'N, 104°43'E

Tiger Conservation Unit No: none

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. Listed as present in the park by Nowell and Jackson (1996) based on Nguyen Xuan Dang and Pham Trong Anh (1991).

Site: 13, **Pu Nhi**, Muong Lat District, Thanh Hoa Province

Locator: ca. 20°30'N, 104°30'E

Tiger Conservation Unit No: none

Protection status: former protected area

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. Listed as present by Nowell and Jackson (1996) based on Nguyen Xuan Dang and Pham Trong Anh (1991).

Site: 14, **Pu Hu**, Thuong Xuan District, Thanh Hoa Province

Locator: ca. 20°25'N, 104°40'E

Tiger Conservation Unit No: 95

Status and conservation of very large mammals in Indochina

Protection status: proposed Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Locals persistently report Tigers; in 1996 one killed two adult and four young cows (Do Tuoc verbally 1998).

Site: 16, **Cuc Phuong**, Nho Quan / Yen Thuy / Vinh Thuy District, Ninh Binh / Hoa Binh / Thanh Hoa Provinces

Locator: ca. 20°14'N, 105°29'E

Tiger Conservation Unit No: none

Protection status: National Park

Level of evidence: extinct?

Class of evidence: not specified

Last positive information: unknown

Notes. Listed for the park by Pfeiffer (1984) but certainly none occurs now (Do Tuoc verbally 1998). It is questionable if the information in 1984 was recent, although the source states that livestock were frequently killed.

Site: 19, **Ben En**, Nhu Xuan District, Thanh Hoa Province

Locator: ca. 19°31'N, 105°25'E

Tiger Conservation Unit No: none

Protection status: National Park

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported by Hoang Hoe and Vo Quy (1991). The only detailed first-hand record gathered by Tordoff *et al.* (1997) was from 1977; one informant reported in May 1997 to have recently found Tiger tracks and other reports indicated that a Tiger may persist around Xuan Than village.

Site: 20, **Quy Chau** District, Nghe An Province

Locator: ca. 19°30'N, 105°15'E

Tiger Conservation Unit No: 97?

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. One was reportedly killed in 1994 (Ha Dinh Duc verbally 1997); the area is close to Pu Huong NR.

Site: 23, **Pu Mat**, Tuong Duong / Con Cuong / Anh Son Districts, Nghe An Province

Locator: 18°40'-19°05'N, 104°25'-105°00'E

Tiger Conservation Unit No: 99

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. One reported by villagers in late 1994 as having been in the area in late 1993 (Kemp *et al.* 1995). In May 1996, a Tiger reportedly ate cows at the Thang Chuong Forest Cooperative (Pham Nhat *in litt.* 1998). Small numbers still probably survive in the reserve (Do Tuoc and Le Trong Trai *in prep.*); reports are most persuasive from Anh Son (Do Tuoc verbally 1998). One report of a recent direct sighting with considerable detail was received in mid 1998 (M. Baltzer verbally 1998).

Site: 26, **Vu Quang**, Huong Khe District, Ha Tinh Province

Locator: 18°09-20'N, 105°18-27'E

Tiger Conservation Unit No: 99

Protection status: Nature Reserve

Level of evidence: confirmed

Class of evidence: remains in village, report

Last positive information: 1993

Notes. Remains were displayed in houses of Phu Quan and Man Chan villages (Mackinnon and Vu Van Dung 1992). A skin was seen in / near the reserve in 1992. In 1994 one was shot and sold a week before a survey team arrived (Do Tuoc verbally 1998). Reported to be caught in non-selective snares in 1994 (Dawson and Do Tuoc 1997). Listed for the reserve, with no further details, by Vu Van Dung *et al.* (1995). Small numbers still probably survive in the reserve and apparently 1-2 are hunted per year (Do Tuoc and Le Trong Trai in prep.).

Site: 27, **Ho Ke Go**, Thach Ha, Huong Khe, Cam Xuyen and Ky Anh Districts, Ha Tinh Province

Locator: 18°00-09'N, 105°50'-106°07'E

Tiger Conservation Unit No: adjacent to 99

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Locals report that footprints are still found annually in the areas of Rao Mon, Rao Buoi and Rao Len. In June 1995, one was reportedly seen near the foot of Bac Toc mountain (Le Trong Trai *et al.* 1996b).

Site: 29, **Phong Nha-Ke Bang**, Bo Trach / Tuyen Hoa / Minh Hoa Districts, Quang Binh Province

Locator: ca. 17°09'N, 106°12'E

Tiger Conservation Unit No: 99

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: unspecified signs, report

Last positive information: 1984

Notes. Signs were seen in 1984 (Pham Trong Anh and Nguyen Xuan Dang n/d) and 10 were estimated in the latter two districts in 1994 on basis of villagers' reports in 1987; three were reportedly killed in 1994 by people of Truong Hoa commune (Do Tuoc *et al.* 1994). A female in the Hanoi Zoological Gardens was reportedly found somewhere in the province as an orphaned cub after a flood in the mid 1990s (Dang Gia Tung verbally 1997). Pham Nhat *et al.* (1995) received a report of a Tiger killing a cow in the Dan Hoa commune (Minh Hoa District) in June 1995 and received other reports from the Hoa Son, Phong Nha and Ba Ren sectors. In November 1995 a cow was reportedly taken by a Tiger in Quang Ninh District (Pham Nhat *in litt.* 1998). Le Xuan Canh *et al.* (1997a) received reports in 1996-1997 of Tigers in three of six survey sectors, including one killing a cow in Dan Hoa commune in 1996 (indications that the species was seen (Appendix 2) or tracks were found (Table 2) on the survey are not detailed in the text).

Site: 30, **Huong Hoa** District, Quang Tri Province

Locator: ca. 16°40'N, 106°40'E

Tiger Conservation Unit No: none

Protection status: none traced

Level of evidence: provisional

Class of evidence: news

Last positive information: unknown

Notes. A report of one maiming fatally an old woman near the Xe Pon river near the Lao border on 28 March 1997 was believed to be the first Tiger attack on a human in the province since 1990 (Lao Dong Newspaper, 3 April 1997). There has been no survey for over 20 years (Do Tuoc verbally

Status and conservation of very large mammals in Indochina

1998).

Site: 31, **Phong Dien** District, Thua Thien-Hue Province

Locator: ca. 16°40'N, 107°20'E

Tiger Conservation Unit No: none

Protection status: proposed Nature Reserve

Level of evidence: confirmed

Class of evidence: report

Last positive information: 1998

Notes. A female believed to be about two years old was confiscated in July 1998 from a taxi-driver in the Phong Mi commune. Locals report that at least two further Tigers are still present in the district (Nguyen Dai Anh Tuan, Thua Thien-Hue Forest Protection Department, per Nguyen Diep Hoa verbally 1998).

Site: 32, **Bach Ma**, Phu Loc District, Thua Thien-Hue Province

Locator: ca. 16°11'N, 107°49'E

Tiger Conservation Unit No: 107

Protection status: National Park

Level of evidence: extinct?

Class of evidence: not specified

Last positive information: unknown

Notes. No recent records for the park itself despite substantial recent effort and presence in A Luoi District (q.v.), forest of which is connected to the national park (WWF/EC 1997); listed as present in the park by Hoang Hoe and Vo Quy (1991) and Nguyen Xuan Dang and Pham Trong Anh (1991).

Site: 33, **A Luoi / Nam Dong** Districts, Thua Thien-Hue Province

Locator: ca. 16°05-20'N, 107°15-30'E

Tiger Conservation Unit No: 107

Protection status: none traced

Level of evidence: confirmed

Class of evidence: news

Last positive information: 1995

Notes. One killed in A Luoi in 1995 (Anon 1996b, WWF/EC 1997). Recorded in both districts by Do Tuoc *et al.* (1994). This area almost abuts Hien / Giang Districts in Quang Nam (q.v.).

Site: 34, **Ba Na-Nui Chua**, Hoa Vang District, Da Nang Municipality

Locator: 16°00'N, 107°58'E

Tiger Conservation Unit No: 107

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Local reports received (Le Trong Trai 1994); also reported from the district by PFPDQN (1996).

Site: 36, **Hien / Giang / Phuoc Son** Districts, Quang Nam Province

Locator: 15°12'-16°03'N, 107°13-49'E

Tiger Conservation Unit No: 107 / 110

Protection status: part proposed Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Still reported by locals to be killed annually and in 1994 fewer than 10 were assessed to remain in the area (Do Tuoc *et al.* 1994). Recorded from this area by Le Trong Trai (1994), which

Tiger records: Vietnam

perhaps include the named localities of Song Bac, Song Nam, Ating and Mcoi. Reported to occur in Hien and Giang Districts by PFPDQN (1996) and reported to be numerous by FPD/FPI/WWF (1997). Further reports were gathered in the area in early 1997, but no material evidence was forthcoming (E. Wikramanayake verbally 1998); indeed Do Tuoc (verbally 1998) is not aware of any such evidence. Do Tuoc and Le Trong Trai (in prep.) considered that in combination with A Luoi (q.v.), the area in 1997 supported 10-16 animals, with 1-2 being poached annually. The relation of these records to the proposed Song Thanh-Dak Pring NR (which falls within the latter two districts) is not clear. A recent questionnaire to local people in Phuoc Son received 156 out of 237 replies indicating continued presence. No signs were found on a brief follow-up field visit (Nguyen Ba Thu 1998).

Site: 38, **Tra My** District, Quang Nam Province

Locator: ca. 15°15'N, 108°10'E

Tiger Conservation Unit No: 111

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. A recent questionnaire to local people in Phuoc Son received 246 out of 310 replies indicating continued presence. No signs were found on a brief follow-up field visit (Nguyen Ba Thu 1998).

Site: 39, **Binh Son** District, Quang Ngai Province

Locator: ca. 15°15'N, 108°45'E

Tiger Conservation Unit No: none

Protection status: none traced

Level of evidence: provisional

Class of evidence: news

Last positive information: unknown

Notes. One killed in 1994 was reported in Lao Dong Newspaper (Ha Dinh Duc verbally 1997).

Site: 40, **Kon Plong** (=Con, Kong Plong) District, Kon Tum Province

Locator: ca. 14°40'N, 108°20'E

Tiger Conservation Unit No: 114

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported from the district (and also neighbouring Dak To) by Dang Huy Huynh *et al.* (1979) on the basis of interviews and / or old documents. The head of the Provincial Forest Protection Department reported in late 1997 that Tigers still occurred (J. Compton verbally 1998). Forestry workers claimed to see fresh tracks of a single animal on a logging road in April 1998 (Huynh Thanh Cong, State Forest Enterprise Vice-Director, per C. Ovel *in litt.* 1998).

Site: 41, **Kon Ha Nung**, An Khe District, Gia Lai Province

Locator: ca. 14°30'N, 108°28'E

Tiger Conservation Unit No: 114

Protection status: contains two Nature Reserve

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1994

Notes. Area incorporates Buon Luoi, Kon Cha Rang NR and Kon Ka Kinh NR; Tigers recorded in primary forest (Dang Huy Huynh *et al.* 1984). One shot by a hunter was seen in 1980 (Pham Trong Anh and Nguyen Xuan Dang n/d). Reports of presence were received and one or more mounted skins were seen in the headquarters of a logging concession in 1988 (Eames *et al.* 1988). In October 1994,

Status and conservation of very large mammals in Indochina

footprints of an adult and a young Tiger were found in the Doc Do area; prints of perhaps the same animals were found in the Suoi Noc area; and prints of adults were found in three areas of Kon Cha Rang (Le Xuan Canh 1995).

Site: 42, **Chu Mom Ray**, Sa Thay District, Kon Tum Province

Locator: ca. 14°25'N, 107°47'E

Tiger Conservation Unit No: 113

Protection status: Nature Reserve

Level of evidence: confirmed

Class of evidence: dung, report, seen

Last positive information: 1997

Notes. About two were killed annually prior to 1990 by people from Mo Rey village alone, with three killed in 1989 (Do Tuoc *et al.* 1994), about two per year in the area up to 1993 with five adults and one cub killed between November 1993 and May 1994 by the staff of one guard post alone; some were killed with mines, some were shot (Do Tuoc and Ngo Tu 1995; Do Tuoc verbally 1998). Four were reportedly killed in the first five months of 1995 (Anon. 1995a). One was killed in the province, presumably in 1995 or early 1996, after it had attacked a person; the precise site is not given (Anon. 1996b). One was seen at 17h00 one day in November 1986 (Do Tuoc *et al.* 1994; Le Vu Khoi verbally 1998). A male collected by Tran Hong Viet near Sa Lon village on 29 December 1981 is now in the collection of the National University of Hanoi. Faeces were found in April 1997, which were too big to be any other cat species (E. Wikramanayake verbally 1997); the guide reported tracks in area two weeks previously (Wikramanayake and Dillon 1997). The park appears to be the best remaining area for Tigers in Vietnam, with 20 estimated in 1994 (Do Tuoc *et al.* 1994) and 10-15 in 1997 (Do Tuoc and Le Trong Trai in prep.). Two males were received from somewhere on the Tay Nguyen Plateau by the Hanoi Zoological Gardens as cubs in May 1997 (Dang Gia Tung verbally 1997).

Site: 43, **Song Ba river / Dak Kron Bung** (= Song Kon), K'Bang District, Gia Lai Province / Kon Plong District, Kon Tum Province and adjacent parts of Binh Dinh Provinces

Locator: ca. 14°20'N, 108°40'E

Tiger Conservation Unit No: 114

Protection status: unclear

Level of evidence: confirmed

Class of evidence: footprints, reports etc.

Last positive information: 1998

Notes. During 1978-1988 Tigers were studied on the Tay Nguyen Plateau, particularly between the Kon and Ba rivers. Over 10 km of the Kon river were found tracks of 9-11 Tigers in December 1983. One female was killed 80 km east of "Nyachang" on 7 October 1986 (Sokolov and Kuznetsov n/d). Taking Nyachang as Kon Plong (also known as Chuong Nghia), this would place the killing site in the then little-settled hilly area well east of the province border into Binh Dinh Province, but probably just within the Kon River headwaters. Animals appear still to remain in this area: in May 1998 a large adult Tiger fell in a pig trap set in forest 4 hours walk from An Toan Commune, An Lao District, Binh Dinh Province; the Tiger escaped from the trap with a damaged foot. Locals estimated 3-4 Tigers in the area (Tinh, Binh Dinh Forest Protection Department, verbally to Nguyen Diep Hoa 1998).

Site: 44, **Chu Prong** District, Gia Lai Province

Locator: ca. 13°25'N, 107°45'E

Tiger Conservation Unit No: 113

Protection status: none traced

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. Tigers occur particularly in the southwest of the area, which abuts Ea Sup District (Do Tuoc *et*

al. 1994, Do Tuoc and Le Trong Trai in prep.).

Site: 47, **Ea Sup** District, Dak Lak Province

Locator: 13°00-20'N, 107°35'-108°00'E

Tiger Conservation Unit No: 113

Protection status: proposed extension to National Park

Level of evidence: provisional

Class of evidence: report

Last positive information: 1986

Notes. Centred on this district is the largest area of deciduous forest in Vietnam, supporting up to 15 Tigers (Do Tuoc *et al.* 1994). Do Tuoc (verbally 1998) observed one around the Ya Hleo one afternoon in April 1978. In the Ya Lop logging concession, Tigers had certainly been common activities began in 1984; a stuffed animal killed 2 km from the enterprise headquarters in 1986 is kept at the headquarters. However there were no recent reports (Le Xuan Canh *et al.* 1997b). Do Tuoc and Le Trong Trai (in prep.) re-stated the area's importance, in combination with Dak Mil District (and Cu Jut and Ban Don, following recent boundary changes) and Chu Prong (Gai Lai; q.v.), estimating that the whole area held 8-10 Tigers. Note that this includes the area known sometimes as the "Green Forest".

Site: 48, **Yok Don**, Ban Don District, Dak Lak Province

Locator: 12°45'-13°00'N, 107°29-50'E

Tiger Conservation Unit No: 113

Protection status: National Park

Level of evidence: confirmed

Class of evidence: seen, footprints, scrapes

Last positive information: 1995

Notes. In 1986 or 1987, Le Xuan Canh (1995) observed a group of Tigers in the park. The density estimated from work in the Srepok basin (thus, some in Ea Sup) in 1986-1987 was of 46+/-16 in 612.5 sq. km and locals claimed to kill one Tiger per year (Dang Zui Khun *et al.* 1991). One was seen from elephant back at a dead young Banteng in April 1988, near the Dak Nar stream (Do Tuoc, Le Vu Khoi verbally 1998). In April 1989, tracks were found on four occasions scattered almost throughout the survey areas; one was less than a week old (Laurie *et al.* 1989). In February-March 1995, footprints were reportedly found a few times, mostly in rivers and one scrape was found (Dang Huy Huynh *et al.* 1995a). A person was reportedly attacked in 1993; one set of footprints was found near the Dak Ken in October / November 1994, with mean dimensions of 10 cm x 10 cm for the hind pad, thus ruling out all other cat species (Le Xuan Canh 1995). Reports of a July 1996 sighting of an adult with two young between Bon Drang Phoc and Yok Don hill, and measured footprints in 1995/1996 (Dang Huy Huynh *et al.* 1997) are apparently misprints for the 1986/1987 sighting and 1994 prints. Villagers reported that prior to 1990, approximately one Tiger was killed per year, but subsequent to that, the only record of conflict was of one which attacked a person in 1993 (it is not clear that all reports refer to the park area). A month's sign-based survey in mid 1997 found no trace of big cats (Le Xuan Canh *et al.* 1997b). A major decline has clearly occurred and occurrence may now be sporadic: the last suggestion of breeding is a local admission that two cubs were taken from a cave in 1996. There was also several reports of sightings in 1997 (E. Kemp *in litt.* 1998).

Site: 49, **Krong Trai** (formerly Suoi Trai), Son Hoa District, Phu Yen Province

Locator: ca. 13°00'N, 108°45'E

Tiger Conservation Unit No: none

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Local reports received (Le Trong Trai 1994, Johnsingh and Nguyen Huu Dung 1995).

Status and conservation of very large mammals in Indochina

Site: 50, **Song Hinh** District, Phu Yen Province

Locator: ca. 12°55'N, 108°55'E

Tiger Conservation Unit No: none

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Local reports indicated presence (Le Trong Trai 1994).

Site: 51, **Ea So** Commune, Ea Kar District, Dak Lak Province

Locator: 12°49'-13°01'N, 108°31'-44'E

Tiger Conservation Unit No: 118?

Protection status: proposed Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. A few reports of Tigers included none more recent than "a few years ago" (Le Xuan Canh *et al.* 1997b).

Site: 53, **Dak Mil** (= Dak Min) / Cu Jut Districts, Dak Lak Province

Locator: 12°15'-12°45'N, 107°15'-108°00'E

Tiger Conservation Unit No: 113

Protection status: contains one Nature Reserve

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. See under Ea Sup.

Site: 54, **Chu Yang Sin**, Krong Bong / Lak Districts, Dak Lak Province

Locator: 12°14'-31'N, 108°17'-35'E

Tiger Conservation Unit No: 120

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Local reports were received of the species in 1995 (Le Trong Trai *et al.* 1996a).

Site: 58, **Bu Gia Map**, Phuoc Long District, Binh Phuoc Province

Locator: ca. 12°09'N, 107°08'E

Tiger Conservation Unit No: 113

Protection status: Nature Reserve

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1990

Notes. Fresh footprints retaining the smell of a Tiger were found in 1990 in the district (Pham Trong Anh and Nguyen Xuan Dang n/d), although it is not clear if they were in the park.

Site: 59, **Bi Doup Nui Ba** (formerly Thuong Da Nhim), Lac Duong District, Lam Dong Province

Locator: ca. 12°04'N, 108°14'E

Tiger Conservation Unit No: 120

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Tiger records: Vietnam

Notes. Villagers from Long Lanh reported the species, but occurrence seems improbable due to the low prey base (Eames and Nguyen Cu 1994, Le Xuan Canh 1995). Tigers were earlier reported from the Lac Duong District by Dang Huy Huynh *et al.* (1982).

Site: 60, **Dak Nong** District, Dak Lak Province

Locator: ca. 12°00'N, 107°45'E

Tiger Conservation Unit No: 113

Protection status: none traced

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. Listed for the area by Dang Huy Huynh *et al.* (1980).

Site: 65, **Cat Tien**, Tan Phu / Bu Dang / Cat Tien Districts, Dong Nai / Binh Phuoc Provinces

Locator: 11°21-34'N, 107°11-28'E

Tiger Conservation Unit No: 120

Protection status: National Park

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. A very small number of Tigers occurs; two were reported as sighted "recently" near the park headquarters (Cox *et al.* 1995).

Site: 66, **Bao Loc / Di Linh** Districts, Lam Dong Province

Locator: ca. 11°30'N, 107°30'E

Tiger Conservation Unit No: 120

Protection status: part Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Tigers were reported in Dang Huy Huynh *et al.* (1982); it is unclear whether reports came from the area now forming Cat Loc NR, which lies partially in Bao Loc District. Two stuffed specimens held at the Da Lat Biological Sub-institute probably came from the province (Pham Trong Anh *et al.* 1996).

Site: 72, **Ta Kou**, Duc Linh District, Binh Thuan Province

Locator: ca. 10°42'N, 107°42'E

Tiger Conservation Unit No: none?

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. Listed as present, (Le Trong Trai 1994). At only 178 sq. km, the reserve is unlikely to support a significant number of Tigers.

Site: 75, **Ngoc Linh**, Dak Glei and Dak To Districts, Kon Tum Province

Locator: ca. 15°05'N, 108°00'E

Tiger Conservation Unit No: 111

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Many local reports were gathered in 1998, including specifically the Lo Xo pass area (Dak Glei District) and Mang Xang Commune (Dak To District). In the latter a Tiger was reported to have

Status and conservation of very large mammals in Indochina

killed a dozen domestic cattle in the last year and in the former a Tiger had recently been observed chasing domestic cattle by day (Le Trong Trai verbally 1998). Note: site out of latitudinal sequence and not mapped as information freshly received after map produced.

Lao

Site: 80, **Phou Dendin**

Locator: 21°40'-22°18'N, 102°00'-40'E

Tiger Conservation Unit No: none

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Respondents in all six villages questioned during 1989-1993 reported the species from their area (Salter 1993a). Villagers in Ban Hat Hin reported last seeing Tigers in the late 1970s. A trader in Phongsali said that there were no longer any Tigers in the province. This was borne out by villagers for the area between the Nam Ou and the Chinese border, but villagers reported elsewhere that some persist between the Nam Ou and the Vietnamese border (Robichaud and Sounthala 1995; W. G. Robichaud and R. J. Tizard verbally 1998).

Site: 85, **Nam Kong**

Locator: ca. 21°11'N, 101°25'E

Tiger Conservation Unit No: 80

Protection status: provincial Protected Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Tigers were reported to take domestic buffalo from time to time but to be very rare (Schaller 1997a, Tizard *et al.* 1997).

Site: 86, **Houay Nam Loy**

Locator: ca. 21°00'N, 100°50'E

Tiger Conservation Unit No: none

Protection status: former proposed protected area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Respondents in four of five villages questioned reported the species from their area (Salter 1993a).

Site: 88, **Phou Dongwin**

Locator: ca. 20°55'N, 101°40'E

Tiger Conservation Unit No: 80

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Villagers report occasional transients (Schaller 1997a).

Site: 89, **Nam Ha** (East and West)

Locator: 20°32'-21°03'N, 100°52'-101°28'E

Tiger Conservation Unit No: 80

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: dung, footprints

Last positive information: 1997

Notes. Respondents in nine of 11 villages questioned reported the species from their area (Salter 1993a). Reported again in 1996; the highest mountain, Phou 2094, seems to be an important site. Repeated problems with livestock predation in the lowlands near Ban Hatnaleng lead to the killing of a

Status and conservation of very large mammals in Indochina

Tiger by explosives hidden within a buffalo, but predation continues (Phiapalath 1996, Tizard *et al.* 1997). In early 1997, relatively fresh faeces were found at Pong Nam Chat and 2 km north of Ban Tonglat Gao; footprints were found along the Houay Lapou-a-ye (near Ban Nam Ya); and Tigers were reported to have killed 10 domestic buffalo in the previous year in the Ban Houay Hoc area (all 870-1500 m) (Tizard *et al.* 1997).

Site: 90, **Nam Kan**

Locator: 20°20'-46'N, 100°38'-54'E

Tiger Conservation Unit No: none

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints, remains (location?)

Last positive information: 1997

Notes. Villagers report 8-12 Tigers in the 780 sq. km. Domestic cattle, buffaloes and horses were taken regularly but recently this has been less of a problem. Tiger signs (primarily footprints) are found on most days in the forest. Signs indicate that one animal in a regularly-visited area is accompanied by a cub (J.-F. Reumaux verbally 1998). One was shot in the area in 1997 (S. Muontha verbally 1998).

Site: 92, **Nam Et**

Locator: 20°09'-50'N, 103°21'-53'E

Tiger Conservation Unit No: none

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints, report

Last positive information: 1997

Notes. Respondents in all six villages questioned during 1989-1993 reported the species from their area (Salter 1993a). Reported by villagers in February 1993 (Berkmüller *et al.* 1995a). A Tiger in the vicinity of either this or the Phou Loey NBCA which reportedly killed 47 cattle was killed by villagers (using a mine) in about 1994-1995 after requests for government assistance with the problem went unanswered; no fines were imposed but the bones were confiscated (WCS 1995a). A Tiger, reported to have taken over 70 domestic buffalo in three years in Ban San Dtur and in several neighbouring villages, was shot on 18 December 1997, with the permission of the Vieng Thong District authorities; the village lies at the western edge of this NBCA and is not far from good habitat in the north of Phou Loey NBCA (T. Hansel *in litt.* 1998). A relatively large number of footprints were found in early 1998 suggesting that the area is very important for the species. Specific localities are: Houay Hin-Dtek (central-south), Ban Sop-Ong (abandoned village, identification provisional), Houay Lone (provisional; north-east), Nam Ngao (several sites; west of boundary) and various areas reported by villagers to be regular sites (Davidson in press).

Site: 93, **Phou Loey**

Locator: 19°50'-20°29'N, 103°00'-23'E

Tiger Conservation Unit No: none

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: unknown

Notes. Respondents in 16 of 20 villages questioned reported the species from their area (Salter 1993a). A stock-eating Tiger in the vicinity was killed (see Nam Et NBCA; WCS 1995a). A relatively large number of footprints and other signs were found in early 1998, including some of young animals, suggesting that the area is very important for the species. Specific localities are: the upper Nam Sa, the Nam Pong, the Nam Sap and various areas in the south reported by villagers to be regular sites, with Ban Sopkhun apparently losing 20 buffalos to big cats in 12 months (Davidson in press).

Site: 94, **Nam Xam**

Locator: 20°02'-14'N, 104°18'-53'E

Tiger Conservation Unit No: 95

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Respondents in ten of 11 villages questioned during 1989-1993 reported the species from their area (Salter 1993a). It was reported again in 1998, from three of five villages; all said it was rare (Showler *et al.* 1998b).

Site: 96, **North of Muong Kham**, Xiangkhouang

Locator: ca. 19°50'N, 103°45'E

Tiger Conservation Unit No: none

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Tigers were reported to persist as rare stragglers; the most recent claims were from 1994 (Schaller and Robichaud 1996).

Site: 99, **Hongsa** special zone

Locator: ca. 19°45'N, 101°45'E

Tiger Conservation Unit No: 81

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Villagers from five localities reported Tigers as present (Bergmans 1995) but no firm evidence was gathered.

Site: 102, **Ban Phouviang** area, South Xiangkhouang

Locator: ca. 19°10'N, 103°50'E

Tiger Conservation Unit No: adjacent to 99

Protection status: none

Level of evidence: extinct?

Class of evidence: report

Last positive information: unknown

Notes. Tigers were reported to have disappeared; they had been abundant in 1953 (Schaller and Robichaud 1996).

Site: 103, **Nam Chouan**

Locator: 18°45'-19°16'N, 103°58'-104°47'E

Tiger Conservation Unit No: 99

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Many were reported from the central part of the area; Tigers were estimated in January 1998 by villagers to kill 7-8 buffaloes per year (W. G. Robichaud verbally 1998).

Site: 104, **Bolikhnan** District, Bolikhamxai Province

Locator: ca. 18°45'N, 103°45'E

Tiger Conservation Unit No: 98

Status and conservation of very large mammals in Indochina

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Province authorities report Tigers as still present (S. Sawathvong verbally 1998).

Site: 105, **Vienthong** District, Bolikhamxai Province

Locator: 18°30'N, 104°45'E

Tiger Conservation Unit No: 99

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported in January 1998 from the lower-lying area east of Phou Kadeung; dates of sightings not established (W. G. Robichaud verbally 1998).

Site: 106, **Nam Phoun** (= Pouï)

Locator: 18°12-47'N, 101°04-29'E

Tiger Conservation Unit No: 81

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints etc.

Last positive information: 1997

Notes. Respondents in 14 of 16 villages questioned during 1989-1993 reported the species from their area (Salter 1993a). In March-June 1997, one set of fresh tracks was found in the upper reaches of the Houay Sung Naak (central sector), possible faeces were found in the north and the species was reported throughout the NBCA and some areas outside. Livestock were occasionally attacked. No evidence of poaching was gathered (Boonratana 1997). S. Muontha (verbally 1998) was informed by villagers that at least eight Tigers used the area. In early 1998, fresh tracks and scrapes were found in the central region near Ban Vang Pha Mon, and tracks were reported from the southwest NBCA from October 1997; reports were received that in 1997 two buffaloes had been taken by Tigers (Boonratana 1998b, R. Boonratana *in litt.* 1998). Tigers were reported in 1998 by Thais to be living across the border (i.e. in Lao) in the area assumed to be to the south of the NBCA, and to be moving in the wet season into Thailand; continued presence in Na Haew NP, Thailand may depend upon adequate protection in Lao (A. J. Lynam *in litt.* 1998).

Site: 107, **Pa Sak Xaignabouli**

Locator: ca. 18°30'N, 101°45'E

Tiger Conservation Unit No: none

Protection status: former proposed protected area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Respondents in eight of nine villages questioned during 1989-1993 reported the species from their area (Salter 1993a).

Site: 109, **Phou Khaokhoay**

Locator: 18°14-34'N, 102°44'-103°29'E

Tiger Conservation Unit No: 98

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Respondents in 15 of 16 villages questioned during 1989-1993 reported the species from their

area (Salter 1993a). A report of an adult buffalo being killed by a Tiger is the most believable of several indications of the species during 1996-1997 (J. Parr verbally 1998); villagers' reports were earlier presented in Salter and Phanthavong (1990).

Site: 110, Sangthong

Locator: ca. 18°20'N, 102°10'E

Tiger Conservation Unit No: none

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. In 1996, several reports were received of intermittent presence in the district, and more regular presence to the west, but in no case was the identification as Tiger rather than Leopard established with satisfaction (Duckworth 1996b).

Site: 112, Nam Kading

Locator: 18°11-39'N, 103°54'-104°44'E

Tiger Conservation Unit No: 99

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: footprints, scrapes

Last positive information: 1995?

Notes. Respondents in both villages questioned in 1989-1993 reported the species from their area (Salter 1993a). Tracks believed to be Tiger's were found at two sites in the Nam Kading valley: downstream of the mouth of the Nam An and on sand banks opposite the abandoned village of Ban Donne. A scrape and tracks were found in the upper reaches of the Houay Basong. Most villagers living around the NBCA thought that Tigers were rare. Note that WCS (1995b) retained these records as provisional. Over 30 years previously, Tigers visited saltlicks between the NBCA and Ban Phonsi; it was not clear whether they came, as the villagers claimed, to eat the soil (Brix and Deuve 1963); this part of the area is now very disturbed.

Site: 113, Nam Hinboun plain

Locator: 18°02-13'N, 104°31-39'E

Tiger Conservation Unit No: 99

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. A wide spread of reports in 1995 from villages close to the forest fringing the plain, of predation of pigs and buffaloes (roughly equal proportions) throughout the year suggests resident Tigers, but no signs could be found (WCS 1995b).

Site: 114, Nam Theun Extension

Locator: 18°21-48'N, 104°45'-105°12'E

Tiger Conservation Unit No: 99

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints, dung

Last positive information: 1997

Notes. Schaller (1995) found tracks in the upper Nam Pan and the upper Nam Chat valleys, and Timmins and Evans (1996) in 1994 had reports of Tigers from the south of the area. However, while Tizard (1996) was informed that Tigers did not occur in the area, WCS (1996b) received reports from Phou Chomvoy. Tracks (greater than 12 cm across) and faeces were found: on the east slope of Phou Chomvoy (1000 m); Nahoua logging road (1150 m); along several km of Nam Chat downstream of

Status and conservation of very large mammals in Indochina

Sop Theung (510-530 m) in February-May 1997. The wide spread implies an important population, doubtless helped by relatively high ungulate numbers (Tobias 1997). On 30 May 1998 a villager reportedly observed a Tiger 500 m from Ban Vangban (at 18°35'N, 105°00'E just west of the Nam Chat river, which forms the western boundary of the area); this was stated to be the first animal seen in the area for two years, although signs were occasionally seen (W. G. Robichaud *in litt.* 1998).

Site: 115, **Nakai-Nam Theun**

Locator: 17°36'-18°23'N, 105°02'-46'E

Tiger Conservation Unit No: 99

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: seen etc.

Last positive information: 1997

Notes. Respondents in 37 of 42 villages questioned during 1989-1993 reported the species from their area (Salter 1993a); some of these were on the Nakai Plateau. In 1994, footprints (greater than 10 cm in length) and / or droppings were found in most sectors, with the Central Mountains identified as an area of major importance; the population of the NBCA, including the Nakai Plateau, was estimated (by A. Rabinowitz; see WCS 1995c) as 20-30 individuals (Timmins and Evans 1996). Specific records include: signs in the headwaters of the Nam Xot, in the upper Nam Mon valley and on a nearby ridge, on a spur of Phou Laoko and on its summit ridge (over 2000 m), the Houay Morrow valley and in the Nam Hue valley; and reports from the headwaters of the Nam Kata, at Ban Namuang and near Ban Taphaiban (claimed sightings at all three in January 1994), near Ban Pong (1993) and around the Nam On (R. J. Timmins *in litt.* 1998). In early 1996 there were three sightings along the Navang logging road, all by day, and all perhaps involving the same, rather small, individual (Duckworth *in press*). In February-May 1997, tracks (greater than 12 cm across) and faeces were found along the Navang logging road (1000-1250 m) and at the Nam Mon / Houay Morrow confluence (750 m). Wide spread implies important population (Tobias 1997).

Site: 116, **Nakai Plateau**

Locator: 17°36'-18°00'N, 104°52'-105°32'E

Tiger Conservation Unit No: 99

Protection status: part National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints etc.

Last positive information: 1996

Notes. Reported to be present, perhaps common (Sayer 1983b). Respondents in 37 of 42 villages questioned during 1989-1993 reported the species from their area (Salter 1993a); some of these were elsewhere in the Nakai-Nam Theun NBCA. Surveys in 1995 indicated (using print size greater than 10 cm total length) that the plateau holds a minimum of five animals (on the basis of differences in print size and the linear distances between the localities). Fresh signs were found in four widely separated localities, with older signs in a further two; a similar distribution was found on the plateau in 1994, when Tiger prints were seen at the Houay Luuk, upstream of Ban Khonken, on a bank in the Nam Theun c. 5 km downstream of Ban Nam Theun and east of Ban Nam Xot. Predation of livestock was widely reported, with residents of Ban Don claiming to lose 20 cattle a year (WCS 1995c, Timmins and Evans 1996; R. J. Timmins *in litt.* 1998). Tracks were again found in 1996: recent tracks of a single went several km along the road into the Phek Phalam area; older tracks, scrapes and droppings were found at several places southwest of Phek Phalam; and old scrapes were found in hills west of the Houay Kechayer (WCS 1996b; R. J. Timmins *in litt.* 1998).

Site: 118, **Khammouan Limestone**

Locator: 17°26'-18°05'N, 104°25'-105°10'E

Tiger Conservation Unit No: 99

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: scrapes, footprints

Last positive information: unknown

Notes. Respondents in six of 14 villages questioned during 1989-1993 reported the species from their area (Salter 1993a). A scrape in early 1996 in the Khuadin area and tracks at the base of Phou Onghon may have been from a Tiger. A buffalo reported as killed in the Ban Khonglor area was the first such incident for many years. The species was reported from eight of 11 villages in early 1998 (Steinmetz 1998b). Records from the Nam Hinboun plain (q.v.) border this NBCA (Timmins 1997).

Site: 119, **Hin Namno**

Locator: 17°15'-40'N, 105°43'-106°09'E

Tiger Conservation Unit No: 99

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints, dung etc.

Last positive information: 1998

Notes. Old and fresh signs (tracks, faeces and scrapes) were found in scattered parts of the area visited in 1996 but may relate to only a small number of individuals and none was confirmed as Tiger (Timmins and Khounboline 1996). The population was reported to be increasing in the recent past; 50 buffalos were claimed to have been killed during 12 months to mid-1997 (Wikramanayake and Dillon 1997). Naturally, the authors specifically caution the reliability of this information. In early 1998 widespread village reports were received and at least one set of tracks (total length 12 cm) was found in the NBCA, about 5 km south-east of the Xe Bangfai river (Walston in prep.).

Site: 120, **Xe Bang Fai**

Locator: ca. 17°00'N, 106°20'E

Tiger Conservation Unit No: 99

Protection status: former proposed protected area

Level of evidence: confirmed

Class of evidence: tracks

Last positive information: 1998

Notes. Two sets of tracks (separated by 10 km) were found on a brief reconnaissance in early 1998 (J. Walston and K. Khounboline verbally 1998).

Site: 121, **Phou Xang He**

Locator: 16°42'-17°04'N, 105°19'-106°06'E

Tiger Conservation Unit No: 99

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1998

Notes. Respondents in 16 of 18 villages questioned during 1989-1993 reported the species from their area (Salter 1993a). In 1993, Duckworth *et al.* (1994) did not confirm any big cat signs found as being a Tiger's. The species was reported to be rare around Ban Phongsavang in 1997 (Marsh 1997b). In early 1998 a fresh track was found in the Phou Xang He range west of Ban Kangnyao (= Ban Thamkouan) and villagers reported seeing an animal in the Phou Hinh block on 8 May 1998 (Boonratana 1998b).

Site: 122, **Dong Phou Vieng**, Savannakhet Province

Locator: ca. 16°26'N, 106°58'E

Tiger Conservation Unit No: none

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Status and conservation of very large mammals in Indochina

Notes. In April-June 1997, Tigers were widely reported as present, specifically their faeces had been found in the Phou Lapeung sector, but the surveyors apparently found no signs themselves (Steinmetz 1998a, Steinmetz and Baird 1997).

Site: 123, **Xe Sap**

Locator: 15°56'-16°19'N, 106°41'-107°28'E

Tiger Conservation Unit No: 106 / 107

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. The usual response by villagers to enquiries was that a Tiger came "last year" or "in April" (Ban Kava and Ban Pihai respectively); in general Tiger seems to be very scarce and to take livestock only occasionally (Schaller and Bounsou 1996). Reported in late 1997 as common in the north-central part of the reserve, with heavy livestock predation occurring there, as having declined in the northeast, and as present in the southwest and the Kaleum district (R. Steinmetz *in litt.* 1998). Reported to take free-ranging buffalo (these are released into forest during August-April each year) and in 1992 one took a buffalo in the village of Ban Tung Kahai (Siripong Thonsongto verbally 1997). In March 1997 one was killed near / h Ror; it was confiscated by Xe Kong Provincial Agriculture and Forestry Office. Villagers from Ban Aluk reported seeing tracks and scats occasionally, and those from Ban Angouas claimed that 1-3 buffalo were lost to Tigers annually (Showler *et al.* 1998a).

Site: 126, **Xe Bang-Nouan**

Locator: 15°44'-16°01'N, 105°53'-106°18'E

Tiger Conservation Unit No: 104

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: remains in village, footprints

Last positive information: 1995

Notes. Respondents in 27 of 28 villages questioned during 1989-1993 reported the species from their area (Salter 1993a). Widely reported in May-July 1995 to take stock, but few signs were found. A single set of prints, probably of Tiger, was found close to Phou Salar, and a single print was found at the base of Phou Houong. The skin and skeleton of a Tiger shot recently in the Central hills was seen in Ban Nongboua (Timmins and Bleisch 1995). Recently, free-ranging cattle (which are released into the NBCA's forest during the agricultural low period of June-November) have been reported as still being attacked, but there is no other recent evidence (R. Dechaineux verbally 1998).

Site: 127, **Phou Xiang Thong**

Locator: 15°19'-56'N, 105°25'-47'E

Tiger Conservation Unit No: 122

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints, dung, scrapes

Last positive information: 1997

Notes. Respondents in seven of eight villages questioned during 1989-1993 reported the species from their area (Salter 1993a). Tigers were reported by villagers in early 1996 to be scarce, but there was difficulty in assessing relative numbers of this species and Leopard; faeces found in the Houay Dua valley were large enough to be from Tiger (Evans *et al.* 1996a). Two sets of fresh tracks, probably including a mother and juvenile together, and 11 scrapes were found on the road between Ban Xaimon and Ban Khamteu in December 1997. Faeces were found in several other localities (Boonratana 1998a).

Site: 128, **Ban Phonthan**, Salavan Province

Locator: 15°43'N, 106°25'E

Tiger Conservation Unit No: none

Protection status: none

Level of evidence: confirmed

Class of evidence: remains in village, photo

Last positive information: 1998

Notes. A young but apparently unaccompanied animal arrived in the neighbourhood of the village in late 1997. After a few weeks of relatively innocuous activity, in early November it began taking stock (a few cows, some pigs and many chickens) and was seen frequently, especially around the stream used as the village water-source; after a lack of response by provincial authorities for action, it was shot on 10 January 1998 (R. Dechaineux verbally 1998). Note that this site is fairly close to the Tha Teng area (q.v.).

Site: 130, **Phou Theung**

Locator: 15°25'-54'N, 106°29'-51'E

Tiger Conservation Unit No: none

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported by villagers (Berkmüller *et al.* 1995a); recent record from Ban Phonthan (q.v.) indicates that the species indeed survives in the general area.

Site: 131, **Tha Teng**

Locator: ca. 15°25'N, 106°20'E

Tiger Conservation Unit No: 108

Protection status: former proposed protected area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Respondents in two of three villages questioned in this area during 1989-1993 reported the species from their area (Salter 1993a).

Site: 132, **Dakchung Plateau**

Locator: ca. 15°20'N, 107°10'E.

Tiger Conservation Unit No: 110

Protection status: part former proposed protected area

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1993

Notes. Respondents in the sole village questioned in this area during 1989-1993 reported the species from their area (Salter 1993a). A footprint (greatest width 13 cm) was found at Phou Kongkling Gnai on 31 December 1993; numerous village reports from this general area are also given, together with a report that residents of the district claim to make a hundred requests per year to the national authorities to deal with problem Tigers (Bergmans 1995; see sect. 6.3.2). Schaller (1995) received reports that Tigers persisted in the area, but was not able to find any signs. In November 1996 the smaller of two Tigers together was shot, 6 km from Muang Dakchung; the skin and bones were confiscated with the proceeds going to the state; the District Agriculture and Forestry Office confiscated the skin and bones and sold them, the profits going to the state. In 1997, Tigers were claimed to be significant predator of livestock (sect. 6.3.2) (Showler *et al.* 1998a).

Status and conservation of very large mammals in Indochina

Site: 134, **Bolaven Northeast** (= Phou Kateup)

Locator: 15°00'-24'N, 106°23'-49'E

Tiger Conservation Unit No: 108

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Several recent sightings on this part of the Bolaven Plateau, including elsewhere within the Xe Namnoy headwaters, were reported in early 1995, which seemed to be reliable (WCS 1995d). One was shot close to the planned location of the powerhouse on the Xe Namnoy dam in early 1995 (Electrowatt International verbally to WCS 1995d). One was apparently seen near Nong Lom in early 1995 (Claridge 1996).

Site: 136, **Xe Khampho**

Locator: 14°35'-15°00'N, 106°11'-35'E

Tiger Conservation Unit No: 113

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported during some of 19 village interviews (Berkmüller *et al.* 1995a).

Site: 137, **Phou Kathong**

Locator: 14°54'-15°19'N, 106°47'-107°14'E

Tiger Conservation Unit No: none

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reports were received in January and April-May 1997 but no details were given (Davidson *et al.* 1997); Tigers were earlier reported on the basis of village interviews by Salter (1993a) and Berkmüller *et al.* (1995a).

Site: 138, **Dong Ampham**

Locator: 14°38'-15°18'N, 107°08'-39'E

Tiger Conservation Unit No: 113

Protection status: National Biodiversity Conservation Area

Level of evidence: footprints

Class of evidence: confirmed

Last positive information: 1997

Notes. Respondents in both villages questioned during 1989-1993 reported the species from their area (Salter 1993a). Schaller (1997b) received numerous reports of Tiger predation on buffaloes and found some signs of big cats, but none was big enough to be certainly identifiable as Tiger. In January and April-May 1997, the following were found: tracks (12.5 cm across) in January at Puong Vong Vhet (Nam Kamah valley); one print (14.5 cm across) in January along the Houay Jenecit, with tracks of a possible cub; and Tigers were reported to take buffaloes in the central-northern hills (Davidson *et al.* 1997).

Site: 139, **Nam Ghong**

Locator: ca. 14°30'N, 107°00'E

Tiger Conservation Unit No: 113

Protection status: Provincial Protected Area; former proposed protected area

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1998

Notes. Tigers were reported to occur by villagers; a track was reportedly found at Ban Hoytan in 1996 and one came near the village of Ban Makteo in 1995 or 1996 (Schaller 1997b). Also reported to Wikramanayake and Dillon (1997) to occur in the area; claimed to take pigs. A single set of footprints was found in early 1998 in the hilly reaches of the Nam Ghong and a few additional local reports were received (Fernando in prep. R. J. Tizard *in litt.* 1998).

Site: 140, Dong Hua Sao

Locator: 14°50'-15°11'N, 105°55'-106°18'E

Tiger Conservation Unit No: 113

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1997

Notes. Respondents in eight of 11 villages questioned during 1989-1993 reported the species from their area (Salter 1993a). In 1996, residents of Ban Houay Phoung reported that occasional footprints were seen around the village, especially in the rainy season, a very clear footprint was found in the middle Houay Namphak, and a walk-in Tiger-trap was found near Houay Bangliang (Evans *et al.* 1996b). Tracks were found in the lowlands near the Houay Namphak in 1997 and a plaster cast was taken (Boonratana 1998a).

Site: 141, Xe Pian

Locator: 13°55'-14°47'N, 105°54'-106°29'E

Tiger Conservation Unit No: 113

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints, dung

Last positive information: 1997

Notes. Respondents in all 11 villages questioned during 1989-1993 reported the species from their area (Salter 1993a). Old tracks of a single animal were found between the Houay Lekfai and Houay Chanang (Dong Kalo) in mid 1992 (Cox *et al.* 1992a). "A few" footprints were seen in the Main Block of semi-evergreen forest in late 1992-February 1993; although species identification was confirmed "on the basis of size", actual measurements are annoyingly not given (Duckworth *et al.* 1994). Faeces and / or footprints were found in November 1996-March 1997 in the Main Block and on the Xe Kong Plains. Villagers said that numbers had declined, that there were few conflicts with people and that, while most Lao were unlikely to hunt Tigers, Cambodians came across the border to hunt them (WWF / Burapha 1997). Earlier reports that Tigers were shot on sight by villagers in Xe Pian (e.g. Duckworth *et al.* 1994) may have erroneous, arising through poorly executed interviews (J. W. Duckworth pers. comm. to WWF / Burapha 1997).

Site: 142, Dong Khanthung

Locator: 14°07'-32'N, 105°12'-45'E

Tiger Conservation Unit No: 122

Protection status: proposed National Biodiversity Conservation Area; currently Protection Forest in some areas, provincial Conservation Forest in others, and unprotected elsewhere.

Level of evidence: confirmed

Class of evidence: footprints, scrapes, dung

Last positive information: 1997

Notes. Reported from all seven villages checked, with tracks usually found in riverine areas; no particular stronghold could be identified. Livestock predation was reported from three villages (Berkmüller and Vilawong 1996). Tracks reported by villagers from Ban Khiem and faeces found south of Ban Pho (ICF 1996). There were three records in 1997: fresh urine, faeces, scrapes near the border nongs camp on 29 March; older evidence 6.6 km north of Ban Khem on 31 March; and fresh tracks along the Nong Po-Ban Tahin road on 3 April (Wolstencroft in prep.). In early 1998, tracks,

Status and conservation of very large mammals in Indochina

faeces and scrapes were found in six localities all in the south and west; areas in the east and centre were also visited, but no signs were found (Round and Vongkhamheng 1998).

Cambodia

Site: 150, **Virachey**

Locator: ca. 14°30'N, 107°10'E

Tiger Conservation Unit No: 113

Protection status: National Park

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1998

Notes. "Commonly" hunted in the park (Robinson and Yem Sokhan 1996). Further reports of hunting were gathered in 1996 by Desai and Lic Vuthy (1996); one informant claimed to have shot three in three years. One policeman interviewed in Veun Say District had killed "a number" of Tigers on specific hunts; the hunting area was one day's walk north of the Xe San (Baird *et al.* 1996). Villagers perceived that numbers dropped in this district during 1980s due to overhunting (A. Maxwell *in litt.* 1998). In the buffer zone, Tigers were reported to be now very rare in O'Lalay; chicken-stealing was reported in early 1997 in villages near Phum Drak / O'Toung; some were reported near Phum Koh Pang Leu (Wikramanayake and Dillon 1997). Footprints were seen in the northeast of the park in 1998 and a report was received of one then two animals seen on successive days in early 1994 by park guards (J. Fraley verbally 1998). Occurs in Phnom Veal Thom, in the core zone, north of Sesan river (A. Maxwell *in litt.* 1998). Local staff reported that 39 Tigers were killed in Veun Sai and Taveng Districts in 12 years to 1998; 14 were killed in 1997 alone (Wikramanayake 1998). Two Tigers occurred around a village on the upper O'Lalay in early February 1998; one was killed. Some hunting parties in the park are Vietnamese. Tracks were observed on sandbars in the O'Lalay in late February 1998 (where one had been shot in 1997) and, fresh, by the Siem Pang river. Informants reported that parts of the park west of the O'Lalay were most important for Tiger (Weiler 1998a).

Site: 152, **Phnom Voene**, Ratanakiri Province

Locator: ca. 14°00'N, 106°45'E

Tiger Conservation Unit No: 113

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: 1998

Notes. Reported by villagers in 1998 to occur, but less commonly than Leopard (Weiler 1998b).

Site: 153, **O'Chum** District, Ratanakiri

Locator: ca. 14°00'N, 107°15'E

Tiger Conservation Unit No: 113

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported to occur in the Tapean forest (Bann 1997) but note the numerous erroneous identifications in the report. Based on the interview results summarised in Heng Kimchhay *et al.* (1998), it seems unlikely that this area supports sizeable numbers of the species.

Site: 154, **Bor Keo** District, Ratanakiri Province

Locator: ca. 13°50'N, 106°50'E

Tiger Conservation Unit No: 113

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Emerson (1997) received reports from villagers. Based on the interview results summarised in Heng Kimchhay *et al.* (1998), it seems unlikely that this area supports sizeable numbers of the

Status and conservation of very large mammals in Indochina

species.

Site: 157, **Yeak Laom** Commune, Ban Lung, Ratanakiri Province

Locator: not traced

Tiger Conservation Unit No: 113

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. One reportedly shot in 1986 was sold to the 'government' for 50,000 riel (A. Maxwell *in litt.* 1998). Based on the interview results summarised in Heng Kimchhay *et al.* (1998), it seems unlikely that this area still supports the species regularly.

Site: 158, **Kulen-Promtep**, Siem Reap Province

Locator: ca. 14°05'N, 104°30'E

Tiger Conservation Unit No: 122

Protection status: Wildlife Sanctuary

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Small numbers were reported in the north of the province; Kulen Promtep WS retains few very large mammals (Heng Kimchhay *et al.* 1998).

Site: 159, **Phnom Kulen**

Locator: ca. 13°40'N, 104°00'E

Tiger Conservation Unit No: 122

Protection status: National Park

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported in February 1993 during interviews with local people (Salter 1993b).

Site: 161, **Lomphat**

Locator: ca. 13°20'N, 107°10'E

Tiger Conservation Unit No: 113

Protection status: Wildlife Sanctuary

Level of evidence: provisional

Class of evidence: footprints

Last positive information: unknown

Notes. Tracks of two animals were reported by Henning (1994) and poaching was reported by local people to be occurring (Desai and Lic Vuthy 1996); the sanctuary south of the Srepok is still reported to contain medium Tiger densities, but the part to the north now appears to be highly degraded and shot out (Heng Kimchhay *et al.* 1998).

Site: 162, **Roniem Daun Sam**

Locator: ca. 13°20'N, 102°10'E

Tiger Conservation Unit No: 124

Protection status: Wildlife Sanctuary

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Two skins in Battambang were reported to be from this area (Seng Teak verbally 1998); hunters' reports from the sanctuary and the surrounding general area gathered in 1998 (Heng Kimchhay *et al.* 1998).

Site: 164, **Northeast Monduliri** Province

Locator: ca. 13°00'N, 107°25'E

Tiger Conservation Unit No: 113

Protection status: none

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1995

Notes. A small area holding an unspecified number of signs in March-April 1994 (Dioli 1994) is believed to be to the west and south of where the Srepok flows in from Vietnam. Two sets of footprints were found in 155 km of survey between Senmonorom and the Srepok river in June 1995 (Sun Hean 1995a). To the north of the Srepok, recent reports of good numbers were gathered in 1998 (Heng Kimchhay *et al.* 1998).

Site: 165, **East Monduliri** Province

Locator: 12°33-55'N, 107°21-32'E

Tiger Conservation Unit No: 113

Protection status: none

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1996

Notes. There were four records of fresh tracks of single Tigers over the 223 km walked in April-May 1996, indicating that they are extremely rare. Only two old trails were found. Five Tiger traps were also found and one freshly killed Tiger was reported (Desai and Lic Vuthy 1996).

Site: 166, **Phnom Prich**

Locator: ca. 12°30'N, 107°10'E

Tiger Conservation Unit No: 113

Protection status: Wildlife Sanctuary

Level of evidence: provisional

Class of evidence: report

Last positive information: 1994

Notes. Hunters' reports suggested that this part of Monduliri Province had the greatest numbers of large mammals (Heng Kimchhay *et al.* 1998).

Site: 167, **Phnom Koe**, Pursat Province

Locator: ca. 12°20'N, 103°35'E

Tiger Conservation Unit No: 125

Protection status: none

Level of evidence: confirmed

Class of evidence: remains in field (photo)

Last positive information: 1997

Notes. A male was shot in the forest in October 1997; the hunters shamelessly guided WPO staff to the site and showed them the fresh carcass. It apparently went to Thailand and fetched 20,000 Baht (Sun Hean verbally 1998). This is within the area of Cambodia identified on the basis of interviews by Heng Kimchhay *et al.* (1998) as supporting a high density of Tigers over a large area.

Site: 168, **Phnom Nam Lyr**

Locator: ca. 12°20'N, 107°50'E

Tiger Conservation Unit No: 113

Protection status: Wildlife Sanctuary

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Occurs (Desai and Lic Vuthy 1996), but less common than in the Phnom Yangke / Yang Por

Status and conservation of very large mammals in Indochina

areas (Lic Vuthy *in litt.* 1998). Hunters' reports suggested that small numbers remain (Heng Kimchhay *et al.* 1998).

Site: 169, **Snoul**

Locator: ca. 11°50'N, 107°00'E

Tiger Conservation Unit No: 113

Protection status: Wildlife Sanctuary

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported in May 1996 to be traded; villagers claim to find footprints annually, especially round eastern Mor Lake (Nhie Thorn and Be Seng Leang 1996). The small sector in Keo Sema District (Mondulkiri) and land outside the sanctuary to the east and north was reported to be much richer than the majority of the sanctuary, in Kratie Province (Heng Kimchhay *et al.* 1998).

Site: 170, **Phnom Aural**

Locator: ca. 11°40'N, 104°05'E

Tiger Conservation Unit No: 125

Protection status: Wildlife Sanctuary

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reports from local people and / or soldiers need checking (Chay Samith verbally 1998). The sanctuary is within or on the edge of the area suggested by interview results to support the highest densities in Cambodia (Heng Kimchhay *et al.* 1998).

Site: 171, **Phnom Tamao**, Takeo Province

Locator: ca. 11°20'N, 104°50'E

Tiger Conservation Unit No: none

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Footprints reported to be found about 1995 (per D. Ashwell verbally 1998).

Site: 172, **Kirirom**

Locator: ca. 11°05'N, 104°00'E

Tiger Conservation Unit No: 125

Protection status: National Park

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Numbers between 0 and 20, according to local soldiers (Lay Khim and Taylor-Hunt 1995). Caution needed as in the report the soldiers are credited with claiming various unlikely identifications of species. Prior to the 1970s, Tigers were easily seen in the area, even within a few hundred meters of buildings (Chhun Sareth verbally 1998); this situation, though sounding surprising, is still true in some other well-protected areas of South-East Asia today, e.g. Khao Yai National Park, Thailand (A. Nettelbeck verbally 1997).

Site: 173, **Phnom Bokor**

Locator: ca. 10°30'N, 104°00'E

Tiger Conservation Unit No: 125

Protection status: National Park

Level of evidence: provisional

Tiger records: Cambodia

Class of evidence: footprints

Last positive information: 1998

Notes. Police living on the plateau reported that they saw Tigers about once per month until their departure in late 1997; most sightings came from the southern third of the park; a skin in a Phnom Penh restaurant reportedly came from the north of the area (K. W. Sorensen verbally 1998). A track of a big cat was found in the park in February 1998 (F. Goes *in litt.* 1998).

Site: 174, **Ream** (Preah Sihanouk)

Locator: ca. 10°20'N, 103°30'E

Tiger Conservation Unit No: 125

Protection status: National Park

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. One reported to be present (DNCP 1995); in late 1997 villagers estimated seven in the park, mainly in the sector east of the Prey Toek Sap estuary and east to the border hills (P. Im verbally 1998).

Yunnan Province, China

Site: 180, **Gaoligongshan**

Locator: ca. 26°00'-28°20'N, 98°20'-40'E

Tiger Conservation Unit No: not applicable

Protection status: National Nature Reserve

Level of evidence: extinct?

Class of evidence: not applicable

Last positive information: unknown

Notes. Last recorded site in Yunnan for regular occurrence of '*P. t. tigris*', but now almost certainly extinct (Wang Yingxiang verbally 1998).

Site: 181, **Wuding** County

Locator: ca. 25°40'N, 102°00'E

Tiger Conservation Unit No: not applicable

Protection status: not known

Level of evidence: provisional

Class of evidence: not applicable

Last positive information: unknown

Notes. Local people reported seeing a Tiger in the late 1980s (Wang Yingxiang verbally 1998).

Site: 182, **Tengchong** County

Locator: ca. 25°00'N, 98°20'E

Tiger Conservation Unit No: not applicable

Protection status:

Level of evidence: provisional

Class of evidence: not applicable

Last positive information: 1985?

Notes. A Tiger which killed a lot of stock was itself killed with poisoned bait in the mid 1980s; this seems to be the last record in Yunnan for '*P. t. tigris*' (Wang Weimin verbally 1998).

Site: 184, **Luchun** County

Locator: ca. 23°45'N, 102°20'E

Tiger Conservation Unit No: not applicable

Protection status: not known

Level of evidence: provisional

Class of evidence: not applicable

Last positive information: 1992?

Notes. A Tiger which mauled several people was killed in the early 1990s with special permission from the government. There is no recent evidence of the species (Wang Yingxiang verbally 1998, Wang Weimin verbally 1998).

Site: 186, **Nanguanhe**, Cang Yuan County

Locator: 23°20'N, 90°00'E

Tiger Conservation Unit No: not applicable

Protection status: National Nature Reserve

Level of evidence: confirmed

Class of evidence: not applicable

Last positive information: 1994

Notes. An adult female and three cubs were killed in January 1984 by local people, as they threaten livestock (Tan Bangjie 1985). Prints were observed in 1994 (Wang Yingxiang verbally 1998) and a population of 2-4 was guessed for 1998, largely on the basis of continued reports of presence by reserve staff (Wang Yingxiang verbally 1998).

Tiger records: Yunnan Province, China

Site: 187, **Hekou** County

Locator: ca. 22°55'N, 103°50'E

Tiger Conservation Unit No: not applicable

Protection status: none

Level of evidence: provisional

Class of evidence: not applicable

Last positive information: unknown

Notes. Reported by local residents (Wang Weimin verbally 1998).

Site: 193, **Xishuangbanna**

Locator: 21°09'-22°36'N, 99°58'-101°50'E

Tiger Conservation Unit No: not applicable

Protection status: National Nature Reserve

Level of evidence: confirmed

Class of evidence: not applicable

Last positive information: 1997

Notes. The Tiger population of Yunnan is almost confined to the Xishuangbanna NNR. From the 1980s onwards, Tigers were regular only in Mengla and Shangyong (the two southernmost parcels) and in unprotected land around them (Wang Yingxiang verbally 1998). In 1997 prints were found in one part of the north of Mengyang; in the north of each of the two northern sectors of Menglun; in three eastern border populations and one area of stream headwaters in the west of Mengla; and in various parts of Shangyong (Jiang Wang Gao verbally 1998).

Numbers were always small and signs were found only infrequently (prints were photographed in about 1990; a population of 10-15 was guessed in 1998 (Wang Yingxiang verbally 1998). However, summing local reports and observed signs from the 1997 survey, Jiang Wang Gao verbally 1998 considers that 5-10 is more realistic. The population decline is best indicated by the skin trade volume: in the 1950s, 20-30 came out of the prefecture per year; by the 1970s only 5-6 were traded annually, and in the 1980s, only 1-2. The visible trade ceased in the 1990s, partly as a result of increased policing and protection deterring people from being involved, partly as a result of the extreme rarity of the species making capture extremely difficult, and partly, doubtless, as a result of prohibition making trade occur secretly (Wang Yingxiang verbally 1998). The population has continued falling in the last decade: in the 1980s Tigers were reported frequently in Mengyang, whereas by the 1990s reports were very infrequent (Jiang Wang Gao verbally 1998).

In 1996 a cub was seen with an adult in Shangyong or Mengla by local officials; reportedly one man was dozing in the sunshine and awoke when the cub sniffed his face. When he stood up both Tigers ran away. In a different incident in June or July 1996 an adult Tiger mauled one of a party of hunters on the head and in the ensuing panic a second hunter shot a third in the leg; the Tiger escaped uninjured, the original victim died and the leg wound healed (Jiang Wang Gao verbally 1998). Farmers in and around Mengla lost 17 then 13 cattle in 1995 and 1996 to Tigers, so in 1997 they moved the area of pasturing cattle by over 5 km; subsequently there has been no significant loss of stock (Jiang Wang Gao verbally 1998).

Site: 194, **Daheishan**, Simung County

Locator: not located

Tiger Conservation Unit No: not applicable

Protection status: not known

Level of evidence: provisional

Class of evidence: not applicable

Last positive information: 1985?

Notes. In the mid 1980s a mother and two cubs appeared and ate a lot of goats, pigs etc. The two cubs were caught alive and taken to the zoo (presumably in Kunming) where they still live and have bred. The fate of the mother is unclear (Wang Weimin verbally 1998).

Annex 2: Asian Elephant records from Indochina

Sites are shown on Fig. 2, numbered as in the text.

Vietnam

Site: 7, **Muong Nhe**, Muong Te / Muong Lay Districts, Lai Chau Province

Locator: 22°00'-26'N, 102°10'-45'E

Tiger Conservation Unit No: none

Protection status: Nature Reserve

Level of evidence: confirmed

Class of evidence: report etc.

Last positive information: 1991

Notes. In the early 1970s elephants occurred throughout most of the park and total numbers perhaps exceeded 200; they were recorded on three visits in the mid-1970s. By 1991, they were reduced to six small populations totalling fewer than 30. Elephant poaching in the province reached a peak in 1987-1989 with at least 30 being killed in the two years 1989-1990 alone (Cox *et al.* 1992b; C. R. Cox pers. comm. to Dawson *et al.* 1993). J. Walston (verbally 1997) suggested that the area by late 1997 contained few if any elephants. Do Tuoc and Le Trong Trai (in prep.) using information from provincial sources estimated that 10-12 remained, in two areas of the park (and nowhere else in the province) in 1997.

Site: 11, **Sop Cop**, Song Ma District, Son La Province

Locator: ca. 20°41'N, 103°42'E

Tiger Conservation Unit No: none

Protection status: Nature Reserve

Level of evidence: confirmed

Class of evidence: report

Last positive information: unknown

Notes. In 1975 the area supported about 77 (Do Tuoc verbally 1998), in 1986 17 (Do Tuoc and Santiapillai 1991), while Do Tuoc and Le Trong Trai (in prep.) using information from provincial sources estimated that only three remained in 1997.

Site: 17, **Pu Hoat**, Que Phong (= Quy Phong) District, Nghe An Province

Locator: ca. 19°45'N, 104°50'E

Tiger Conservation Unit No: 95

Protection status: proposed Nature Reserve

Level of evidence: confirmed

Class of evidence: dung etc.

Last positive information: 1994

Notes. This is one of four populations in the province and was estimated (as Thong Thu and Hanh Dich) to hold 15-20 animals in 1994. The high human density in the areas means that there is no possibility of linking these four populations by natural habitat. However the area adjoins extensive similar forest in Lao (Dawson and Do Tuoc 1997). It is not clear if any elephants remain, although the site has been recommended as a priority site for the restoration of the elephant population (Do Tuoc and Le Trong Trai in prep.). Some other sources call the site Bu Huong, resulting in potential confusion with a protected area of that name (q.v. as Pu Huong).

Site: 18, **Pu (= Bu) Huong**, Que Phong / Quy Hop / Quy Chau Districts, Nghe An Province

Locator: ca. 19°41'N, 104°42'E

Tiger Conservation Unit No: 97

Protection status: contains one Nature Reserve

Level of evidence: confirmed

Class of evidence: seen, dung, footprints

Status and conservation of very large mammals in Indochina

Last positive information: 1996

Notes. There were 5-8 residents in 1994 including a very young calf in a small area of highly fragmented degraded forest in Quy Hop / Quy Chau. The forest areas used by the elephants are separated by vast blocks of agricultural land. Crop damage was increasingly frequent and by 1994 two people had died; three elephants were killed in retaliation. Villagers reported changes in habits (presence in a new area, Mon Son, and more prolonged presence in Nam Son where elephants were previously seasonal), presumably reflecting the disruption of natural habitat (Dawson and Do Tuoc 1997). Several footprints were seen in April 1995 and reports were received of a small group in secondary growth to the north of the reserve, which lies in Que Phong (Kemp and Dilger 1996); Pham Nhat (*in litt.* 1998) considered that the group contained eight animals. A visit in late 1996 found that conflict levels were still high and elephants were no longer seen in areas they had frequented only a few years previously. Two adults were thought to remain in Nam Son commune, with a larger herd in Chau Thai commune (Walston *et al.* 1996); this report contains considerable detail on elephant-human problems in the area. J. Walston (verbally 1997) suggested that the area may by late 1997 contain few or no elephants.

Site: 19, **Ben En**, Nhu Xuan District, Thanh Hoa Province

Locator: ca. 19°31'N, 105°25'E

Tiger Conservation Unit No: none

Protection status: National Park

Level of evidence: confirmed

Class of evidence: footprints, dung

Last positive information: 1993

Notes. In December 1992-January 1993 footprints and dung were found in the western part of the park; 6-8 individuals, including a young calf, were estimated. Elephants were killed frequently in the late 1970s but this seemed rare by the early 1990s. Human / elephant conflict seems low. Between 1965 and 1993, the population changed from a widespread, resident one, to a patchily distributed wandering one, living at low density. The animals live in Nhu Xuan District, in an area known as Vuc Dua, which in 1993 lay without the park; use of the park itself was erratic. It is possible further elephants live in the forests adjoining Vuc Dua (Dawson *et al.* 1993). The last local report from the park itself gathered by Tordoff *et al.* (1997) was in 1994. Do Tuoc and Le Trong Trai (*in prep.*; and verbally 1998) felt that the species could well be locally extinct and J. Walston (verbally 1998) doubts that more than 3-4 remain if any.

Site: 21, **Ky Son** District, Nghe Anh Province

Locator: ca. 19°20'N, 104°00'E

Tiger Conservation Unit No: adjacent to 99

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. There were some village reports during 1991-1995 but the increase in disturbance to the area makes it unlikely that significant numbers survive (Do Tuoc verbally and *in litt.* 1998).

Site: 22, **Nghia Mai**, Nghia Dan District / Dong Van, Tan Ky District, Nghe An Province

Locator: ca. 19°05'N, 105°15'E

Tiger Conservation Unit No: none

Protection status: not known

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Village reports of five and four were received in 1991-1995 (Do Tuoc *in litt.* 1998).

Site: 23, **Pu Mat, Tuong Duong / Con Cuong / Anh Son** Districts, Nghe An Province

Locator: 18°50'-19°10'N, 104°30'-105°10'E

Tiger Conservation Unit No: 99

Protection status: Nature Reserve

Level of evidence: confirmed

Class of evidence: footprints, feeding damage, dung

Last positive information: 1996

Notes. Only the western extremity of the reserve is extensively occupied: in the forests of Khe Thoi, Tuong Duong District, and Cao Veu lives possibly the largest single elephant population in northern Vietnam. A population of 50 was estimated in 1994 (Dawson and Do Tuoc 1997), but this figure is now considered too high; it was derived largely from villagers' reports (Trinh Viet Cuong verbally 1998). Signs were recorded at the base of a peak of 1652 m (on Phu Xam Liem) and suggest possibly movement between Vietnam and Lao. There is a discrete small population in and beyond the eastern extremity of the reserve in Anh Son District. Elephant density appeared in 1994 quite high and conflict with people was not infrequent: crops and buildings were destroyed (Dawson and Do Tuoc 1997; Trinh Viet Cuong verbally 1998). Damage was also reported by Rozendaal (1990). Elephants have reportedly not been seen in the centre of the reserve since the 1970s (Dawson and Do Tuoc 1997), although they were reported by villagers from the international border of Con Cuong District (Rozendaal 1990).

Three appeared in January 1994 and returned again in December 1994 to the Khe Moi / Phu Loong area well away from the international border; they are reportedly unusual in this area (Kemp *et al.* 1995). A revisit to Anh Son and the adjacent Thanh Chuong District in late 1996 found that conflict levels had massively increased between 1994 and 1996, partially as a result of the establishment of a permanent village, cultivating large areas of crops palatable to elephants, in an area formerly (1993) supporting a herd of nine elephants. These now live as two herds (of four and three), split by a road; the other two were shot in 1994 (Walston *et al.* 1996). This report contains considerable detail on elephant-human problems in the area. Dawson's (1996) estimate for the reserve as a whole of 60-80 is now clearly much too high.

In mid 1998 herds remained in the Khe Moi and Tuong Duong Districts (M. Baltzer verbally 1998). Signs were found at about 1600 m, and there is no reason to suppose movement does not take place across the international boundary (R. J. Timmins verbally 1998).

A male reportedly came from this province, about four years old in 1997, was sent from the Hanoi Zoological Gardens to the Nanning Zoo in China in late 1997 (Dang Gia Tung verbally). Do Tuoc and Le Trong Trai (in prep.) using information from provincial sources estimated that only 24 remained in the province in 1997.

Site: 24, **Thanh Chuong** District, Nghe An Province

Locator: ca. 18°40'N, 105°20'E

Tiger Conservation Unit No: 99

Protection status: none traced

Notes. See Pu Mat.

Site: 25, **An Bun Valley**, Huong Son District, Ha Tinh Province

Locator: ca. 18°30'N, 105°10'E

Tiger Conservation Unit No: 99

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: 1990

Notes. Reported in July 1990 by villagers to be regular (Rozendaal 1990); some were reported during 1991-1995 (Do Tuoc *in litt.* 1998).

Site: 26, **Vu Quang**, Huong Khe District, Ha Tinh Province

Locator: 18°09'-20'N, 105°18'-27'E

Status and conservation of very large mammals in Indochina

Tiger Conservation Unit No: 99
Protection status: Nature Reserve
Level of evidence: confirmed
Class of evidence: seen etc.

Last positive information: 1997

Notes. Elephants were formerly numerous along the Nam Truoi river, but have now declined greatly from human settlement of this area, and poaching; most of the 12 or so animals estimated to remain in 1992 were females (Mackinnon and Vu Van Dung 1992). Only part of the reserve, Dan Thai, is occupied. Elephants are shy but nonetheless are frequently seen close to the reserve; 8-22 residents were estimated in 1994 (Dawson and Do Tuoc 1997). Four were watched feeding in secondary growth close to the reserve headquarters one early afternoon in December 1997; locals reported that seven animals lived in this herd (Tran Minh Hien verbally 1997).

Site: 27, **Ho Ke Go**, Thach Ha, Huong Khe, Cam Xuyen and Ky Anh Districts, Ha Tinh Province

Locator: 18°00-09'N, 105°50'-106°07'E

Tiger Conservation Unit No: adjacent to 99

Protection status: Nature Reserve

Level of evidence: confirmed

Class of evidence: remains in village, report etc.

Last positive information: 1998

Notes. One or more skulls were seen in the possession of local hunters in Ky Anh in 1988 (Eames *et al.* 1988). In 1975 when the lake was built many elephants used to live in Ky Thuong, according to a local hunter. A Scandinavian team in 1993 estimated 7-10 remained in the area. In 1994, elephants remained nearby in the Ha Dong Forest Cooperative (Huong Khe District). By 1995, no information could be traced on elephants remaining in the Ho Ke Go area; two jaws (unaged) were found near the border of Ha Tinh and Quang Binh. Locals informed that hunting had been heavy in the past (Le Trong Trai *et al.* 1996b). There was increasing conflict between elephants and people living southwest of the area; within four years to 1994, 48 elephants were reportedly poached. Animals are killed for ivory, meat and hides, and only 3-4 seemed to remain by 1994; recent surveys have not found signs in this area (Dawson and Do Tuoc 1997; Do Tuoc verbally 1998). Three were observed in the reserve by villagers and reserve staff saw footprints in 1998 (Le Trong Trai verbally 1998).

Site: 29, **Phong Nha-Ke Bang**, Bo Trach District, Quang Binh Province

Locator: ca. 17°09'N, 106°12'E

Tiger Conservation Unit No: 99

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Local people informed Pham Nhat *et al.* (1995) that four elephants occurred in the Da Deo mountain pass in 1992, but they had not been seen recently. Le Xuan Canh *et al.* (1997a) listed elephant as having been observed (Table 2) or reported by locals (Appendix 2) in the area in 1996-1997 but gave no details in the text. Small numbers were reported in 1994 from nearby Tuyen Hoa District (Le Trong Trai *et al.* 1996b). A female, about 45 years old in 1997, in the Hanoi Zoological Gardens reportedly came from this province. She was acquired in the mid 1980s after working in the forestry industry (Dang Gia Tung verbally 1997).

Site: 32, **Bach Ma**, Phu Loc District, Thua Thien-Hue Province

Locator: ca. 16°11'N, 107°49'E

Tiger Conservation Unit No: 107

Protection status: National Park

Level of evidence: extinct?

Class of evidence: report

Last positive information: unknown

Elephant records: Vietnam

Notes. During the war, troops used elephants on Bach Ma mountain; these were released when the troops left (J. A. Fairfax pers. comm. in WWF/EC 1997). A 1989 estimate of 25 was given by Le Vu Khoi and Do Tuoc (1992). WWF/EC (1997) traced the following reports: singles killed in the Debay Pass (1987) and in Thuong Lo commune (1989), tracks reported south of the old 14B road in 1990 (per Pham Mong Giao pers. comm.), and tracks reported during winter 1994-1995 in Khe Trong region close to Quang Nam-Da Nang (per Ngo Viet Nhon 1995). There are no recent records from the park but elephants may survive in the area (Do Tuoc verbally 1998).

Site: 35, **Que Son** District, Quang Nam Province

Locator: ca. 15°40'N, 108°15'E

Tiger Conservation Unit No: 111

Protection status: none traced

Level of evidence: confirmed

Class of evidence: dung etc.

Last positive information: 1997

Notes. In June 1997, local information suggested that 6-8 may remain and dung was seen towards the border with Giang District (Walston *et al.* 1997).

Site: 36, **Giang / Phuoc Son** Districts, Quang Nam Province

Locator: 15°12'-16°03'N, 107°13'-49'E

Tiger Conservation Unit No: 107 / 110

Protection status: part proposed Nature Reserve

Level of evidence: confirmed

Class of evidence: report

Last positive information: 1997

Notes. Local information (hunters' reports and provincial authorities) suggested that in the province there were four groups totalling 36 animals in 1990 and three groups totalling 22-24 in 1994; two were in Giang, the third was in Phuoc Son. In 1990 near the Song Thanh river gold-seekers killed all but three of an entire herd (Le Trong Trai 1994). Reported, but no detail given by PFPDQN (1996). Dawson (1996) estimated that 40-50 elephants inhabited the area. A hunter saw a herd of 15-20 elephants at Cau 32 (15°35'N, 107°50'E) in December 1997; he reported that these were the first he had seen in many years hunting the area (J. Compton verbally 1998). Do Tuoc and Le Trong Trai (in prep.) using information from provincial sources estimated that only 19-31 remained in the province in 1997; this is well below the 860 estimated for the province in about 1980 (Do Tuoc 1991), but reports of specific poaching groups targeting elephants (e.g. one group killed at least 16 in 1994) indicate that a major decline has indeed occurred. See also Que Son District. The relation of these records to the proposed Song Thanh-Dak Pring NR is not clear.

Site: 38, **Tra My / Tien Phuoc** Districts, Quang Nam Province

Locator: ca. 15°15'N, 108°10'E

Tiger Conservation Unit No: 111

Protection status: none traced

Level of evidence: confirmed

Class of evidence: seen

Last positive information: 1997

Notes. A herd of eight invaded a civilian area of village 1 of Tra Duong commune (Tra My); animals were not afraid of noise and disturbed 5 ha of crops (Lao Dong newspaper of 16 September 1997; Ha Dinh Duc verbally 1998). A group of seven (including a male and a calf) was seen in Tra My in June 1997 (Walston *et al.* 1997). The herd apparently ranges into Tien Phuoc as well. Reports were received of a further group of eight or so in the latter district but their presence could not be confirmed. Serious conflict is likely as the elephants are restricted to a tiny relict forest patch (J. Walston verbally 1998).

Status and conservation of very large mammals in Indochina

Site: 39, **Quang Ngai** Province

Locator: ca. 15°00'N, 108°30'E

Tiger Conservation Unit No: 114?

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. A herd numbered nine in 1990 and seven in 1994, according to local informants (Le Trong Trai 1994).

Site: 40, **Kon Plong (=Con, Kong Plong)** District, Kon Tum Province

Locator: ca. 14°40'N, 108°20'E

Tiger Conservation Unit No: 114

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: 1998

Notes. Reported from the district (and also neighbouring Dak To and Dak Gleih) by Dang Huy Huynh *et al.* (1979) on the basis of interviews and / or old documents. A herd of six was reported to Le Trong Trai (1993), as was a herd of nine in Dak To. The head of the Provincial Forest Protection Department reported that in the first week of January 1998 a herd of 15-20 elephants had been observed (J. Compton verbally 1998). Forestry workers claimed regularly to see a herd of 10-15 in early 1998 (Huynh Thanh Cong, State Forest Enterprise Vice-Director, per C. Ovel *in litt.* 1998). It is likely that only 1-2 herds persist (Do Tuoc verbally 1998).

Site: 41, **Kon Ha Nung**, An Khe District, Gia Lai Province

Locator: ca. 14°30'N, 108°28'E

Tiger Conservation Unit No: 114

Protection status: includes 2 Nature Reserves

Level of evidence: provisional

Class of evidence: report

Last positive information: 1988?

Notes. Area incorporates Buon Luoi, Kon Cha Rang NR and Kon Ka Kinh NR; elephants were recorded in primary forest, concentrated in the latter two areas by Dang Huy Huynh *et al.* (1984). A 1986 estimate of 16 and eight respectively in Kon Cha Rang and Kon Ka Kinh was given by Le Vu Khoi and Do Tuoc (1992). Reports of small numbers were received in 1988 (Eames *et al.* 1988). A herd of seven was reported to remain in Kon Cha Rang to Le Trong Trai (1993).

Site: 42, **Chu Mom Ray**, Sa Thay District, Kon Tum Province

Locator: ca. 14°25'N, 107°47'E

Tiger Conservation Unit No: 113

Protection status: Nature Reserve

Level of evidence: confirmed

Class of evidence: report

Last positive information: 1997

Notes. The distribution in the Sa Thay area apparently went from an extensive, continuous area of occupancy, probably with over 100 elephants, in 1980, to two isolated populations in 1992, with fewer than 15 in total (Le Vu Khoi and Do Tuoc 1992). Three herds totalling 18-20 animals were reported for the district as a whole to Le Trong Trai (1993), as was a herd of nine animals from adjacent Ngoc Hoi District. Local reports in 1995 suggested that there were about 30 in 1984, but by 1995 there were only 10-11 left, in two groups: one of about four in the Sa Loong area near the international border and one of 5-6 in the Chu Do area in Ea Tri Commune (Do Tuoc and Ngo Tu 1995). Reported in April 1997 again from close to the Cambodian border but seem to be peculiarly scarce; most likely to occur in July / August (Wikramanayake and Dillon 1997). Animals seem to

Elephant records: Vietnam

have been restricted to the west of the park since the opening of an army base in the east (Do Tuoc verbally 1998). Do Tuoc and Le Trong Trai (in prep.) using information from provincial sources estimated that only 14 remained in the province in 1997.

Site: 43, **K'Bang** District, Gia Lai Province

Locator: ca. 14°20'N, 108°40'E

Tiger Conservation Unit No: 114

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Local reports suggest a few may persist (Do Tuoc verbally 1998). A young animal from somewhere in Gia Lai Province, which had died of disease, was received by the Xuan Mai Forestry College in January 1997 (Pham Nhat verbally 1998). Do Tuoc and Le Trong Trai (in prep.) using information from provincial sources estimated that five remained in the province in 1997.

Site: 44, **Chu Prong and Duc Co** Districts, Gia Lai Province

Locator: ca. 13°25'N, 107°45'E

Tiger Conservation Unit No: 113

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. A herd of 10-12 was reported from Chu Prong, with a herd of eight reported from Duc Co (Le Trong Trai 1993).

Site: 46, **A Yun Pa** (= Ajun Ba, Iajunba, A Yunba) District, Gia Lai Province

Locator: ca. 13°20'N, 108°30'E

Tiger Conservation Unit No: 117

Protection status: none traced

Level of evidence: extinct?

Class of evidence: not specified

Last positive information: unknown

Notes. Mapped as present by Do Tuoc and Santiapillai (1991) but area is a new economic zone (Le Trong Trai verbally 1998) and is now badly degraded and elephants are unlikely to persist (Do Tuoc verbally 1998).

Site: 47, **Ea Sup** District, Dak Lak Province

Locator: 13°00'-20'N, 107°35'-108°00'E

Tiger Conservation Unit No: 113

Protection status: proposed Nature Reserve

Level of evidence: confirmed

Class of evidence: report

Last positive information: 1992

Notes. Elephant catchers in Ban Don and Bon Drang Phok stated in early 1992 that all eight elephants caught since 1990 came from north of Yok Don NP, because the park itself (q.v.) had very few elephants. Six herd of 70 animals were estimated by villagers in the early 1990s; the area then included Ban Don District (Le Trong Trai 1993). Scattered signs in the Ya Lop and Chu Mulanh areas in mid 1997 were all in areas likely to be visited by tamed elephants (Le Xuan Canh *et al.* 1997b). However, Do Tuoc and Le Trong Trai (in prep.) believed from local reports that some wild animals remained. A male, about 10 years old in 1997, in the Hanoi Zoological Gardens reportedly came from this province, having spent some years in the Hanoi circus (Dang Gia Tung verbally). Bon Drang Phok village has reportedly caught 50 wild elephants for taming between 1975 and November 1995 (Lao Dong Newspaper, 26 May 1996). The 502 tamed elephants in the province were

Status and conservation of very large mammals in Indochina

documented by district in Dang Huy Huynh *et al.* (1980) and Trinh Viet Cuong (in prep.). Do Tuoc and Le Trong Trai (in prep.) using information from provincial sources estimated that 42 wild animals remained in the province in 1997.

Site: 48, **Yok Don**, Ban Don District, Dak Lak Province

Locator: 12°45'-13°00'N, 107°29'-50'E

Tiger Conservation Unit No: 113

Protection status: National Park

Level of evidence: confirmed

Class of evidence: seen etc.

Last positive information: 1997

Notes. In April 1989, recent tracks of a small herd of elephants including a very young calf were found near the Dak Ta (south of Yok Don hill), and old tracks were found in the east (Laurie *et al.* 1989). Fresh signs were found once in October 1990 (Cox and Ha Dinh Duc 1990). Reasons for their assignment to wild animals were not given in either report or in Cox *et al.* (1992a). A 1989 estimate of 69 was given by Le Vu Khoi and Do Tuoc (1992) and one of 80-100 by Dang Huy Huynh *et al.* (1990). In early 1992, Dawson *et al.* (1993) were informed by local elephant catchers that very few elephants persisted in the park. Dawson (1996, verbally 1997) estimated a park population of 40-50 at this period, from a reconnaissance using a subjective assessment of the numbers of signs. During 1995 and 1996, it was reported that tracks (wild or tamed) were found daily, elephants were heard twice at night and animals were seen twice; the park population was estimated at 60-70 on the basis of village opinion (Dang Huy Huynh *et al.* 1995a, 1997, Le Xuan Canh verbally 1997). However, some of this information was apparently from substantially prior to 1995, thus explaining the marked contrast with the information received by Dawson *et al.* (1993) from the elephant catchers themselves. Elephant capture was reported still to be occurring, with singles being caught in November 1995 and March 1996 (Dang Huy Huynh *et al.* 1997), although whether these came from the park itself is not clear. In September 1996, Pham Nhat (*in litt.* 1998) was informed in 1996 by hunters of Bon Drang Phok and Ban Don that two elephant herds lived in the international border area of the park. During May-June 1997, signs (of wild or tamed animals) were found in most places visited in the park, but only around Yok Da were indications of a herd found. This suggests that the natural population has been greatly reduced and fragmented. In July 1997 a small group was seen at very close quarters near the Dak Ken (O. Nikolai per Pham Trong Anh verbally 1997), suggesting that herds do still visit the park at least occasionally. A three-year old male was caught by people from Tul village (Ea Wel Commune, Ban Don District) in mid December 1997; the precise site of capture was not established (Vu Dieu Huong verbally 1998), although it was believed to be in the park (E. Kemf *in litt.* 1998).

Separating signs of tamed elephants (which are allowed to roam freely for extended periods; S. Dawson verbally 1997, and are taken in for various purposes, e.g. with illegal hunting parties; Cox and Ha Dinh Duc 1990) from those of wild animals in Yok Don is not easy (sect. 4.2.1). The majority of the signs found in 1997, and perhaps also in recent previous years, probably came from tamed animals (see discussion in Le Xuan Canh *et al.* 1997b). There is no doubt that the park population has collapsed (the 1997 surveys were in the areas of the park that had formerly been good for elephants; Le Xuan Canh verbally 1997), although precisely when this occurred is unclear. Locals confirmed in 1998 to Vu Dieu Huong (verbally 1998) that very few wild elephants remain: two sightings were reported from 1997, a single and two tuskless males opposite Bon Drang Phok and Ban Don respectively.

Site: 49, **Krong Trai** (formerly Suoi Trai), Son Hoa District, Phu Yen Province

Locator: ca. 13°00'N, 108°45'E

Tiger Conservation Unit No: none

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Elephant records: Vietnam

Notes. A herd numbered five in 1994, according to local informants (Le Trong Trai 1994); some may yet persist (Do Tuoc verbally 1998).

Site: 51, **Ea So** Commune, Ea Kar District, Dak Lak Province

Locator: 12°49'-13°01'N, 108°31'-44'E

Tiger Conservation Unit No: 118?

Protection status: proposed Nature Reserve

Level of evidence: extinct?

Class of evidence: remains in field, report

Last positive information: c.1987

Notes. Remains of four single dead animals were found during April-May 1997, but all were very old. Locals confirmed that the last animal was shot in the late 1980s (Le Xuan Canh *et al.* 1997b). One herd of four was reported to remain in the district to Le Trong Trai (1993).

Site: 52, **Dak Mang**, Dak Mil District, Dak Lak Province

Locator: ca. 12°30'N, 107°45'E

Tiger Conservation Unit No: 113

Protection status: none traced

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. This area was reported to support a population in danger of fragmentation by Dawson (1996), but Le Trong Trai (1993) found that villagers believed that only one herd, of six animals, remained in the entire district; two herds totalling 18 were reported for adjacent Cu Juit District, which was formerly part of Dak Mil. Listed for the district by Dang Huy Huynh *et al.* (1980).

Site: 54, **Chu Yang Sin**, Lak / Krong Bong Districts, Dak Lak Province

Locator: 12°14'-31'N, 108°17'-35'E

Tiger Conservation Unit No: 120

Protection status: Nature Reserve

Level of evidence: confirmed

Class of evidence: news

Last positive information: 1997

Notes. A female in the Krong Bong District devastated crops and killed one person on 16 April 1997; with permission from the Prime Minister, this animal was shot (Lao Dong newspaper, April 1997; WWF files, source unclear). Eames and Nguyen Cu (1994) doubted that the area would support a resident population of elephants, and concluded that villagers' reports probably referred to animals south of the proposed reserve in the Dak Kring Kno watershed, or seasonal visitors from parts of Lak District to the west. Locals reported that unusually elephants occur in dryland rice-fields which may be within their former range; in 1995, villagers found three in the Ea K'Tour valley (Le Trong Trai *et al.* 1996a). Le Trong Trai (1993) received reports of a herd of five animals somewhere in Lak District; animals were previously reported from Lak District by Dang Huy Huynh *et al.* (1980).

Site: 55, **Nam Nung**, Dak Mil (= Dak Min) District, Dak Lak Province

Locator: ca. 12°16'N, 107°45'E

Tiger Conservation Unit No: 113

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. May still occur in the reserve (Do Tuoc and Le Trong Trai in prep.).

Site: 56, **Nam Ka**, Krong No District, Dak Lak Province

Locator: ca. 12°15'N, 107°55'E

Status and conservation of very large mammals in Indochina

Tiger Conservation Unit No: 113

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. A 1989 estimate of 25 was given by Le Vu Khoi and Do Tuoc (1992), and a herd of 12 were reported to Le Trong Trai (1993). Some may yet remain (Do Tuoc verbally 1998).

Site: 57, **Ta Dung** (formerly Quang Xuyen), Dak R'Lap District, Dak Lak Province

Locator: ca. 12°10'N, 107°30'E

Tiger Conservation Unit No: 113

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Mapped as present by Do Tuoc and Santiapillai (1991); two herds totalling 12 were reported for the district to Le Trong Trai (1993).

Site: 58, **Bu Gia Map**, Phuoc Long District, Binh Phuoc Province

Locator: ca. 12°09'N, 107°08'E

Tiger Conservation Unit No: 113

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. A 1990 estimate of 17 was given by Le Vu Khoi and Do Tuoc (1992). It is possible, although not likely, that some may yet remain (Do Tuoc verbally 1998).

Site: 59, **Bi Doup Nui Ba** (formerly Thuong Da Nhim), Lac Duong District, Lam Dong Province

Locator: ca. 12°04'N, 108°14'E

Tiger Conservation Unit No: 120

Protection status: Nature Reserve

Level of evidence: extinct?

Class of evidence: report

Last positive information: unknown

Notes. Villagers from Long Lanh reported that the species had been extinct in the reserve since 1975 (Eames and Nguyen Cu 1994), but 1993 villagers estimated that two herds totalling about 16 animals remained. Smaller numbers were also reported from Di Linh and Bao Loc Districts (Le Trong Trai 1993). A specimen held at the Da Lat Biological Sub-institute probably came from the province (Pham Trong Anh *et al.* 1996).

Site: 60, **Dak Nong** District, Dak Lak Province

Locator: ca. 12°00'N, 107°45'E

Tiger Conservation Unit No: 113

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. A herd of nine animals was reported to Le Trong Trai (1993).

Site: 65, **Cat Tien**, Tan Phu / Bu Dang / Cat Tien Districts, Dong Nai / Binh Phuoc Provinces

Locator: 11°21-34'N, 107°11-28'E

Tiger Conservation Unit No: 120

Protection status: National Park

Elephant records: Vietnam

Level of evidence: confirmed

Class of evidence: unspecified signs

Last positive information: 1997

Notes. In early 1992, there was a herd of 20 (methodology or source not given) in the southwest of the Nam Cat Tien sector (Daim 1992). In February-March 1992, signs were found at four locations in the centre and west of the park (Dawson *et al.* 1993); animals move outside park boundaries (Cox *et al.* 1995). Local reports confirmed that animals still occurred in at least the Dong Nai sector in 1997 (Pham Mong Giao *et al.* 1997).

Site: 68, **Ninh Phuoc** District, Ninh Thuan Province

Locator: ca. 11°30'N, 108°50'E

Tiger Conservation Unit No: adjacent to 120

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. A herd of six in 1994 caused frequent damage to vegetation, according to local informants (Le Trong Trai 1994).

Site: 70, **Tan Phu** Forest Enterprise (= "North Duc Linh" *sensu* Daim 1992), Tan Phu District, Dong Nai Province

Locator: 11°05'N, 107°20'E

Tiger Conservation Unit No: none

Protection status: proposed protected area

Level of evidence: confirmed

Class of evidence: news etc.

Last positive information: 1998

Notes. A herd of about 12 animals was considered to have no long-term viability and translocation to Cat Tien recommended by Do Tuoc and Santiapillai (1991). A dry season count in 1991 or 1992 estimated 13 animals (based on tracks, photographic analysis (subject of analysis not given) and local information). The herd was then centred upon the North Duc Linh District, Binh Thuan Province but roamed over into adjacent parts of Lam Dong Province (villages of Sung Nhon, Nam Chinh, Duc Kai, Duc Chinh and Duc Hanh) and Dong Nai Province (Tan Phu). Human-elephant conflict was severe: the herd killed 12 people in 1989-1991 in the Duc Linh district alone, and two were killed, another injured, by poachers (Daim 1992). Further detail on conflict is given in Dawson *et al.* (1993). Small numbers reported in Dang Huy Huynh *et al.* (1982) for Duc Trong District, Lam Dong Province presumably refer to these animals. Four wild animals were captured in nearby Dinh Quan District during 29 September-2 October 1993 (Cong An TP Ho Chi Minh City newspaper, October 1993), but none appears to have been successfully released in another area.

Human-elephant conflict escalated in the Tan Phu District in November 1997. There was substantial damage to people, crops and buildings. Three small groups totalling 10-16 elephants, including males, females and a 4-5 year old juvenile, were assessed to live in the area, centred on the Forest Enterprise, in December 1997. They form one of the largest and most viable herds still extant in Vietnam (Pham Mong Giao *et al.* 1997). It is likely that the "North Duc Linh" herd has been joined by animals from other areas (see Bien Lac-Nui Ong) to form the Tan Phu herd of 1997 (J. Walston verbally 1998). Do Tuoc and Le Trong Trai (in prep.) using information from provincial sources estimated that 28 remained in the province in 1997; this includes this population and some in Cat Tien NP (q.v.).

Site: 71, **Bien Lac-Nui Ong** (= "South Duc Linh"), Tanh Linh District, Binh Thuan Province

Locator: ca. 11°00'N, 107°03'E

Tiger Conservation Unit No: 120

Protection status: Nature Reserve

Level of evidence: confirmed

Status and conservation of very large mammals in Indochina

Class of evidence: footprints etc.

Last positive information: 1993

Notes. A dry season count in 1991 or 1992 estimated 14 animals (based on tracks, photographic analysis (subject of analysis not given) and local information). The herd was separated from the North Duc Linh herd by a settled area; the area they roamed over was considered to include Bien Lac swamp and the villages of Gia An, Duc Tai, Tan Ha, Tra Tan and Ba Ta. Human-elephant conflict was severe; seven houses were destroyed in Gia An village in Tanh Linh District in 1981, and at least two subadult males were poached in 1981-1991 (Daim 1992); the latter referred to this herd as the South Duc Linh-Tanh Linh herd. Further detail on conflict is given in Dawson *et al.* (1993). Some animals may have been involved in an abortive translocation attempt in 1993 which involved deaths of both elephants and a capturer (Santiapillai 1993b). These animals remain separate from the Tan Phu District, Dong Nai Province (q.v.) (Nguyen Xuan Dang verbally 1998).

Site: 73, **Bau Lam**, Xuyen Moc District, Ba Ria-Vung Tau and Ham Than District, Binh Thuan Provinces

Locator: 10°40'N, 107°30'E

Tiger Conservation Unit No: none

Protection status: part Nature Reserve

Level of evidence: extinct?

Class of evidence: footprints etc.

Last positive information: 1993

Notes. A herd of about nine animals around Nui Be was considered to have no long-term viability and translocation to Cat Tien recommended by Do Tuoc and Santiapillai (1991). A 1991/1992 dry season count estimated 10 females (based on tracks, "photographic analysis" and local information). The last male died in December 1991 by falling into a water-filled bomb crater. Human-elephant conflict was less severe than with the two herds to the north. The lack of a male meant that the herd was no longer viable (Daim 1992). There was a bout of records in 1991-1992, mainly in Xuan Trong and Xuan Truong village areas: on 20 September, 18 October, 17 November 1991, and in one undated incident elephants killed single people. On 3 December 1991, a dead elephant was found in Xuan Trong. On 28 August 1992 a man was killed near Bung Rieng, and another was killed a few days later near Phuoc Bun. Four people were killed nearby on 5 December 1992. On 30 December 1992, six people were trampled near the Bien Lac NR. In the four years to mid 1993, elephants in the area killed 30 people, injured 13 more and caused 5 million dongs' worth of damage. Further detail on conflict is given in Dawson *et al.* (1993).

Two animals were captured during 1-15 June 1993 (Tuoi Tre Ho Chi Minh City newspaper, 17 June 1993, Thanh Nien newspaper, 27 June 1993). This abortive translocation attempt involved deaths of both elephants and a capturer (Santiapillai 1993b) and not one elephant was successfully released into the wild (Do Tuoc and J. Walston verbally 1998). Although there is now the large Binh Chau-Phuoc Buu NR in the Xuyen Moc District, no elephants remain in the area (Do Quang Tung verbally 1998).

Lao

Site: 80, **Phou Dendin**

Locator: 21°40'-22°18'N, 102°00'-40'E

Tiger Conservation Unit No: none

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1996

Notes. Salter (1992a) found signs of recent use by elephants of a saltlick on the east bank of the Nam Ou in March 1992. Tracks were found near a hot spring on the Nam Ou near the mouth of the Nam Khang (2-4 individuals) and along the Nam Ou a few km downstream of the mouth of the Nam Toho (probably <3 individuals); villagers reported that wild animals were present (Robichaud and Sounthala 1995). Tracks were found at the same saltlick on 27 March 1996 (W. G. Robichaud and R. J. Tizard verbally 1998). The area used to support many elephants (K. Boupa per C. Inthavong *in litt.* 1998).

Site: 81, **Nam Khang**

Locator: ca. 22°15'N, 101°55'E

Tiger Conservation Unit No: none

Protection status: former proposed protected area

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. Reported to be present (Phanthavong and Santiapillai 1992).

Site: 82, **Boun Nua** District, Phongsali Province

Locator: ca. 21°40'N, 101°45'E

Tiger Conservation Unit No: none

Protection status: none

Level of evidence: confirmed

Class of evidence: report

Last positive information: 1997

Notes. A single appeared by the Chinese border in December 1997 and caused some problems with crop fields, the first time this had happened in this area for 20 years; it is presumed to have come from Mengla (Yunnan) (S. Sawathvong verbally 1998).

Site: 83, 18 km south-east of **Muong Yo**, Phongsali Province

Locator: 21°20'N, 102°00'E

Tiger Conservation Unit No: none

Protection status: none

Level of evidence: confirmed

Class of evidence: report

Last positive information: 1996

Notes. A herd estimated by villagers as up to 40-50, reportedly composed solely of females / infants, appeared and damaged crops in January 1996 (W. G. Robichaud verbally 1998). These animals presumably came from Mengla (Xishuangbanna NNR, Yunnan)

Site: 84, **Ban Houidam**, Muong Sinh

Locator: 21°15'N, 101°15'E

Tiger Conservation Unit No: none

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Status and conservation of very large mammals in Indochina

Notes. A young and rather tame animal appeared in the wet seasons of 1996 and 1997 and joined a herd of buffalo. It caused some damage to crops, but no more so than a buffalo. A request has been put into the provincial authorities to deal with it as there is concern what the animal will be like when mature; on account of its lack of fear of people it is suspected it may have been in captivity at some stage; it may be the young animal which reportedly escaped from a convoy going from Thailand to China in early 1996 (S. Sawathvong verbally 1998, M. Meredith *in litt.* 1998).

Site: 85, **Nam Kong**

Locator: ca. 21°11'N, 101°25'E

Tiger Conservation Unit No: 80

Protection status: Provincial Protected Area

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1996

Notes. Chinese reportedly attract elephants and other animals over the border by setting out salt (Phiapalath 1996). Old prints were found in early 1997 (Tizard *et al.* 1997).

Site: 86, **Houay Nam Loy**

Locator: ca. 21°00'N, 100°50'E

Tiger Conservation Unit No: none

Protection status: former proposed protected area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Respondents in all five villages questioned in February 1991 reported the species from their area (Salter 1991a).

Site: 87, **Nam Ou**

Locator: ca. 21°00'N, 103°00'E

Tiger Conservation Unit No: none

Protection status: former proposed protected area

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. No details given (Venevongphet 1992).

Site: 88, **Phou Dongwin**

Locator: ca. 20°55'N, 101°40'E

Tiger Conservation Unit No: 80

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Villagers reported no resident population, but said that one animal appeared briefly in 1996 (Schaller 1997a).

Site: 89, **Nam Ha** (East and West)

Locator: 20°32'-21°03'N, 100°52'-101°28'E

Tiger Conservation Unit No: 80

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported to be present by Phanthavong and Santiapillai (1992) and villagers reported the

Elephant records: Lao

species to be present in mountainous areas of the NBCA (Phiapalath 1996), but Tizard *et al.* (1997) found no physical evidence of the species.

Site: 90, **Nam Kan**

Locator: 20°20-46'N, 100°38-54'E

Tiger Conservation Unit No: none

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: report

Last positive information: 1998

Notes. Villagers report about 20 wild elephants concentrated in the northwestern sector. Animals are declining, due primarily to the proximity of a large resettlement site (J.-F. Reumaux verbally 1998). Earlier village interviews (Berkmüller *et al.* 1995a) had not detected these elephants, presumably because of their limited distribution.

Site: 91, **Nam Yo**

Locator: ca. 20°10'N, 101°55'E

Tiger Conservation Unit No: 81

Protection status: former proposed protected area

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. Reported possibly to be present by Phanthavong and Santiapillai (1992), but date of information not given.

Site: 92, **Nam Et**

Locator: 20°09-50'N, 103°21-53'E

Tiger Conservation Unit No: none

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: unknown

Notes. One village of 11 questioned in March 1991 in the area of the former Muang Hiam proposed protected area (which overlaps somewhat with this NBCA) reported the presence of elephants (Salter 1991b). Elephants were reported in February 1993 by villagers (Berkmüller *et al.* 1995a). In early 1998, signs probably those of a reported group of six animals (including one calf) from the 1997 wet season were found at several sites in the Phou Thamdin-Phou Hinhe-Houay Te area in the northeast of the NBCA. Villagers from Ban Sopvek, also in the northeast, reported that 4-5 elephants were killed in 1985 just outside the NBCA along a tributary of the Nam Vek; elephants had not been observed in the area since. There could be other groups left in the south, but it may be that the NBCA now supports only this one small group (Davidson in press).

Site: 94, **Nam Xam**

Locator: 20°02-14'N, 104°18-53'E

Tiger Conservation Unit No: 95

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: dung, report

Last positive information: 1997

Notes. Reports of depredation of cultivated areas of Xam Tai District, perhaps involved only three animals (Phanthavong and Santiapillai 1992). Villagers from Ban Phieng Hom said three females had moved into the area and used a saltlick on the north of the Nam Xam in the east of the NBCA; droppings and tracks estimated to about five months old were seen between Muang Xamtai and Ban Phieng Hom (Showler *et al.* 1998b). Animals reportedly used to be regular at a certain season around

Status and conservation of very large mammals in Indochina

Ban Thalao, but have not occurred since about 1994 (T. Hansel *in litt.* 1998). Vietnamese poachers are reportedly active (K. Khounboline verbally 1998).

Site: 98, **Long Leng**

Locator: ca. 19°50'N, 104°40'E

Tiger Conservation Unit No: 95

Protection status: former proposed protected area

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. Reported to be present (Phanthavong and Santiapillai 1992).

Site: 100, **Nam Dik Headwaters**, Houaphan Province

Locator: 19°45'N, 104°30'E

Tiger Conservation Unit No: 95

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reports were gathered in 1993 from within Vietnam of four poached in Lao (Dawson and Do Tuoc 1997).

Site: 101, **Nam Feuang**

Locator: ca. 19°10'N, 102°00'E

Tiger Conservation Unit No: none

Protection status: former proposed protected area

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. No further details (Venevongphet 1992).

Site: 103, **Nam Chouan**

Locator: 18°45'-19°16'N, 103°58'-104°47'E

Tiger Conservation Unit No: 99

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: 1997

Notes. Reported to be present by Phanthavong and Santiapillai (1992) and Venevongphet (1992). In January 1998 residents of a village on the margin of the area reported many to be present in at least some parts of the NBCA (W. G. Robichaud verbally 1998).

Site: 104, **Bolikhan** District, Bolikhamxai Province

Locator: ca. 18°45'N, 103°45'E

Tiger Conservation Unit No: 98

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Province authorities report elephants (date of report not ascertained) (S. Sawathvong verbally 1998).

Site: 106, **Nam Phoun** (= Pouï)

Locator: 18°12'-47'N, 101°04'-29'E

Tiger Conservation Unit No: 81

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints etc.

Last positive information: 1997

Notes. Significant populations were reported to occur in Xaignabouli Province in 1983; with animals still being captured from the wild (Sayer 1983b). An estimate of 400-500 for this area (i.e., not solely the NBCA, but including Pa Sak Xaignabouli (q.v.) and others) in 1992 was expressly stated to be unreliable (Phanthavong and Santiapillai 1992). In March-June 1997, fresh evidence was common in the centre and south of the NBCA, but in the north it was found only in the northwest. Tracks of young were found. A population size estimate of 350-500 animals, expressly stated to be crude, was based upon sightings and fresh signs. Tamed elephants are common nearby and are released untended in forest for extended periods (June/August-November/December each year). Poaching is a threat: eight were killed in 1995, three in 1996, and one in April 1997 (Boonratana 1997). S. Muontha (verbally 1998) was given details of two herds, totalling 47 individuals, by villagers: one visited wetlands around villages in the southwestern enclave until 1995 or 1996, and the other inhabited the Ban Nakong area to the east of the reserve. In early 1998 a report was received of one shot by poachers in February, groups of 30 and ten animals were reported respectively from November 1997 and January 1998 near Pong Phoy in the northeast of the reserve, and all saltlicks visited showed signs of use by wild elephants (see sect 4.2.1); these were spread widely in the NBCA, including the north. A group of three were seen at Pong Sa-art on 22 March. Summing all these pieces of evidence, the population was again estimated at about 350 individuals (Boonratana 1998b, R. Boonratana *in litt.* 1998). The Provincial Agriculture and Forestry Office of Xaignabouli had on record that 696 tamed animals were in the province in 1996-1997 (Boonratana 1998b).

Site: 107, **Pa Sak Xaignabouli**

Locator: ca. 18°30'N, 101°45'E

Tiger Conservation Unit No: none

Protection status: former proposed protected area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported by villagers in March 1991 to be present in eight of the nine interviewed villages in the area (Salter 1991c); see also Nam Phoun.

Site: 108, **Muang Khi**

Locator: ca. 18°25'N, 101°55'E

Tiger Conservation Unit No: none

Protection status: former proposed protected area

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. Reported to be present (Phanthavong and Santiapillai 1992).

Site: 109, **Phou Khaokhoay**

Locator: 18°14'-34'N, 102°44'-103°29'E

Tiger Conservation Unit No: 98

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: dung, footprints, feeding damage, report

Last positive information: 1998

Notes. Reported by villagers during interviews at 13 villages in 1988-1989 (Salter and Phanthavong 1990) but feared extinct by 1992 following disturbance from logging (Phanthavong and Santiapillai 1992). However, in 1994 abundant signs were found in the Nam Hi region. Signs were found 8 km

Status and conservation of very large mammals in Indochina

east of Ban Na and became more frequent further into the forest, with piles of dung every few hundred meters; villagers reported two separate herds, of eight and about 30, during August-September 1994 (Payne *et al.* 1995). In 1998 J. Parr (verbally 1998) estimated from a summation of villagers reports that two herds each of about 30 were present. Animals were reported from both sides of the Muang Hom road in the eastern part of the protected area: to the west, in Nam Hi and south to the border, whence elephants sometimes emerge into farmland; and to the east around Phou Khonhouat. As no signs of them were ever seen on the Muang Hom road (which bisects that NBCA) itself, despite frequent visits, or reported it is clear that two herds are involved. A long-dead animal was found in 1997; its tusks had been removed (J. Parr verbally 1998). Crop raiding was reported in at least 1994.

Site: 110, **Sangthong** District / Phou Phanang

Locator: ca. 18°20'N, 102°10'E

Tiger Conservation Unit No: none

Protection status: part National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints, feeding damage, dung, report

Last positive information: 1998

Notes. Signs were found widely over the northern two-thirds of the Sangthong district in 1996; in February-March fresh signs were seen between Ban Wangma and Ban Taohai in the north, and there were two reports of direct sightings by villagers. Villagers reported a total of 50 animals in three herds (Duckworth 1996a). Precise locations of signs and reports, and information on the not infrequent human-elephant conflicts, is given in Duckworth (1996b). The elephants of this area move to Phou Phanang NBCA and are particularly prone to cause damage around Ban Taohai (west of Phou Phanang), although they also descend to cultivated areas east of Phou Phanang (S. Sawathvong verbally 1998). In January 1998 a herd estimated by villagers as numbering 15-20 visited the area of Ban Koua, well to the south of their usual range (D. Bräutigam verbally 1998).

Site: not numbered, **Vientiane** province

Locator: see Sangthong / Phou Phanang and Phou Khaokhoay.

Tiger Conservation Unit No: 98

Protection status: see Sangthong / Phou Phanang and Phou Khaokhoay.

Level of evidence: see Sangthong / Phou Phanang and Phou Khaokhoay.

Class of evidence: see Sangthong / Phou Phanang and Phou Khaokhoay.

Last positive information: see Sangthong / Phou Phanang and Phou Khaokhoay.

Notes. Reported by forestry workers to be present in most forest areas of Vientiane province and quite numerous in some localities (Sayer 1983b). Estimate of 200-300 for 1992 expressly stated to be unreliable. Eleven poached in July 1991 alone (Phanthavong and Santiapillai 1992). See also Sangthong / Phou Phanang and Phou Khaokhoay.

Site: 112, **Nam Kading**

Locator: 18°11-39'N, 103°54'-104°44'E

Tiger Conservation Unit No: 99

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints, feeding damage, dung, report

Last positive information: 1995

Notes. Signs were ubiquitous on the high ridges in the eastern NBCA in December 1994-January 1995; villagers claimed a group of three lived in the area. Faeces and tracks were found between the mouths of the Houay Basong and the Nam Mouan. Old signs were found on the south slope of Phou Ao. A footprint was found beside the Nam Ngom near Ban Sop Ngom (WCS 1995b). Over 30 years previously elephants visited saltlicks, according to the local hunters, during the full moons of certain months, between the NBCA and Ban Phonsi, but visit levels were already dropping as a result of rampant hunting (Brix and Deuve 1963); the area is now very disturbed.

Site: 113, **Nam Hinboun Plain**

Locator: 18°02'-13'N, 104°31'-39'E

Tiger Conservation Unit No: 99

Protection status: none

Level of evidence: confirmed

Class of evidence: footprints, report

Last positive information: 1997

Notes. A herd of about six came into the area from the Nam Kading NBCA in late 1997 and ate in rice fields; locals stated that this unusual occurrence relates to the disturbance of construction of the Theun-Hinboun dam (W. G. Robichaud verbally 1998). However, in 1995, villagers also reported occasional crop damage in this area, and said that each year elephants came down from the hills of the Phou Hai area (Khammouan Limestone NBCA) to the plain in the late dry season (presumably about March) and returned to the hills again in June. At least one group was reported to be involved. Signs from the 1994 wet season were seen in the northwest of the plain in 1995 (WCS 1995b).

Site: 115, **Nakai-Nam Theun**

Locator: 17°36'-18°23'N, 105°02'-46'E

Tiger Conservation Unit No: 99

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints, feeding damage, dung, report

Last positive information: 1994

Notes. The Nakai Plateau (q.v.) is the most important part of the area. Elephants also occur in the NBCA in the Central Mountains and (at lower densities) in the Southern and Northern Mountains and in the Northern Border Hills. In total, up to 150-250 were estimated to occur in the area (including the Nakai Plateau) in 1994 (Timmins and Evans 1996). Villagers at Ban Navang reported there were often elephants on Phou Song, one informant suggesting as many as 30; signs were seen there in January 1994. Signs were also seen in the upper Nam Mon valley, on the ridge between it and the Houay Morrow, east of Ban Guner (very old; villagers reported the species was now very rare). Damage and faeces seen at several points on a ridge (1200-1400 m) beyond the end of the Navang logging road were probably all from a small group that had passed a month or more ago (R. J. Timmins *in litt.* 1998). WCS (1996a) listed the species from the road itself, in error; the species was thus not listed from there by Duckworth (in press). Tobias (1997) did not record elephants in 1997 from a variety of sites in the NBCA away from the Nakai Plateau, re-emphasising the importance of the latter. It is not clear whether elephants ever go high enough in the Nam Theun mountains to cross the international border into Vietnam (K. Khounboline, R. J. Tizard verbally 1998). The species has evidently been declining for some time and this is continuing: villagers in Tasaeng Thapaiban reported in 1994 that elephants had been absent since the time of the French Occupation. Many villages (as well as at Ban Kha-oy on the Nakai Plateau) said that elephants disappeared over the last few years due to heavy poaching by the Vietnamese (R. J. Timmins *in litt.* 1998). At least one was poached in 1998 (K. Khounboline verbally 1998).

Site: 116, **Nakai Plateau**

Locator: 17°36'-18°00'N, 104°52'-105°32'E

Tiger Conservation Unit No: 99

Protection status: part National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: seen, etc.

Last positive information: 1997

Notes. Reported to be present, perhaps numerous in 1983 (Sayer 1983b). Estimate of 150-300 for 1992 expressly stated to be unreliable (Phanthavong and Santiapillai 1992). The Nakai Plateau was considered to be the most important part of the Nakai-Nam Theun area for elephants in 1994 (Timmins and Evans 1996). In both 1994 and 1995, they were found in the east of the plateau mainly north and west of the Nam Theun, while in the west they were more widespread; many records came

Status and conservation of very large mammals in Indochina

from close to villages. Important sites found in 1994 included a saltlick 1 km north of the Nam Theun and about 3 km upstream of the mouth of the Nam Xot, where most large trees in an area of 2 ha had been used as rubbing posts (R. J. Timmins *in litt.* 1998). Considerable detail for the 1995 records is given in WCS (1995c), and an estimate derived from the geographical spread of signs is given of the plateau population being about 100-150 animals. In the absence of detailed knowledge of seasonal movements, the relation of this number to the additional <150 estimated from elsewhere in the NBCA, and the animals present elsewhere in the region (Nam Theun Corridor proposed NBCA, Khammouan Limestone NBCA, Nam Hinboun plain etc; q.v.), is unclear.

Evidence was again found on the Plateau in 1996: substantial numbers occur within the inundation area of the Nam Theun 2 hydroproject (WCS 1996b). Well established elephant trails were found southwest of Phek Phalam (R. J. Timmins *in litt.* 1998).

An estimate of 100-150 head for 1997 is based on hunters' assessments. Three herds totalling about 40 animals were seen: south of Ban Namxot between the Nam Xot and the Nam Theun (two seen, 4-5 hidden), near the mouth of the Houay Hhai, near Sop Phai (about nine) and near the Keng Luang rapids (22-25 individuals) (Tobias 1997; K. Khounboline verbally 1998).

Some seasonal movement occurs into the limestone of the Nam Theun Corridor area to the southwest and at least two herds reportedly spend a month in November-December around Ban Nabon. Around the lower Nam On, elephants have reportedly not occurred since 1992 and the last sighting around Ban Phonsavang was in July 1996. The area is largely deforested and elephants seem to have left the area, presumably in response to the disturbance. Considerable further detail is given about local distribution and seasonal movements. Few are found elsewhere in the Nakai-Nam Theun NBCA and environs (Tobias 1997; K. Khounboline verbally 1998).

Poaching pressure has been sustained and severe; it is probably even higher in the mountainous parts of the NBCA than on the plateau. Nine were killed by poachers in 1991 alone (Phanthavong and Santiapillai 1992). Large numbers (a major part of 42) were killed by poachers during 1991-1992 in the Nakai-Nam Theun area (Dobias 1993). Five poached carcasses were found in 1994-1995 at the Nam Theun / Nam Xot saltlick; some of these were so old they were probably included in Dobias's figures, but two in 1994 were dead only about three months (WCS 1995c, Timmins and Evans 1996; R. J. Timmins *in litt.* 1998). Summing reports, about 30 cases of poaching seem known to the informants for the period of 1990-1996 (Tobias 1997).

Site: 117, **Nam Theun Corridor**

Locator: 17°46'-18°10'N, 104°48'-105°06'E

Tiger Conservation Unit No: 99

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: seen

Last positive information: 1995

Notes. A herd of about nine, including a small young animal (W. G. Robichaud verbally 1995) was seen near Keng Luang in late January 1995; villagers reported that they were present regularly (WCS 1995b). In 1993, elephants arrived in the Nam Ngoy/Nam Theun confluence area (not within the existed or proposed protected areas network); they were presumably displaced from the Nakai Plateau by human activity related to the Nam Theun 2 hydropower project (Tobias 1997: 10-11, 64). See also information under Khammouan Limestone NBCA and Nakai Plateau.

Site: 118, **Khammouan Limestone**

Locator: 17°26'-18°05'N, 104°25'-105°10'E

Tiger Conservation Unit No: 99

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1995

Notes. Reported from the northern forest fringing the NBCA (Timmins and Evans 1996). Signs from late 1995 were seen throughout the surveyed parts of the central forest area in 1996. Local people

maintained that elephants visit this area seasonally (October-December) from the Nakai Plateau, via the Houay Namahung. The southern part is likely to be more important because of the high densities of bamboo, streams and waterholes. Old signs were also found on Phou Onghon in February 1996; a small group reportedly ranges on the western slope of this mountain, on the Phou Hai / Phou Mon Plateau and across the lower Nam Hinboun lowlands to the south; this is probably the same population as that seen in the Nam Theun Corridor proposed NBCA and the Nam Hinboun plain (q.v.). These areas, and the Houay Namahung, are outside the current boundaries but need urgently to be protected as habitat links between this NBCA, the Nakai Plateau and the Nam Kading NBCA (Timmins 1997). The species was reported as persisting at four and extinct at three of 12 villages in early 1998; specific reported locations were Phou Mon, to the north of the NBCA and within the NBCA in Kouan Song Hong and Phou Ak summit; the total population was reported to be 50 (Steinmetz 1998b).

Site: 119, Hin Namno

Locator: 17°15'-40'N, 105°43'-106°09'E

Tiger Conservation Unit No: 99

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: dung

Last positive information: 1997

Notes. In May 1997 a report was received of a herd of six in the area of the NBCA (Wikramanayake and Dillon 1997). Field survey in early 1998 found only one sign: a pile of old dung in a dry streambed near a saltlick 15 km west of the boundary. This suggests that the NBCA population is very small, locally distributed and only erratically present. Local informants stated that a herd of 4-8 animals persisted and that there were no tamed animals in the area (Walston in prep.).

Site: 120, Xe Bangfai

Locator: ca. 17°00'N, 106°20'E

Tiger Conservation Unit No: 99

Protection status: former proposed protected area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported to be present (Phanthavong and Santiapillai 1992, Venevongphet 1992); date of original information not given. Reported in early 1996 by villagers from forest on the border with Xaibouathong and Boualapha Districts (Timmins and Khounboline 1996).

Site: 121, Phou Xang He

Locator: 16°42'-17°04'N, 105°19'-106°06'E

Tiger Conservation Unit No: 99

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: heard, feeding damage, footprints, report

Last positive information: 1997

Notes. Two independent estimates by villagers in 1993 were of 40-50 animals in the area; usage of the northwestern two-thirds of the Phou Xang He massif was believed to be low, due to hunting and other human disturbance, although direct persecution of elephants was not reported (Phanthavong and Dobias 1993). A herd was smelt and heard feeding in bamboo 3-6 km south of Ban Kham on 15 and 16 April 1993; villagers said they appeared regularly at this season following water stress on the hills. Much vegetation damage and dung were found east and northeast of Ban Nalai in late April 1993; none was very fresh and again villagers stated the signs were left by animals wandering in search of water (Duckworth *et al.* 1994). Reported to be still present near Ban Nalai in 1997; villagers seemed to suggest this was the most important remaining area of the NBCA for the species (Marsh 1997b). All field evidence and opinion from local people from work in early 1998 indicated

Status and conservation of very large mammals in Indochina

that elephants are now restricted to the forested areas between Ban Nalai and Ban Katep, although previously they occurred almost throughout the NBCA. One animal was directly encountered about 2 km west of Ban Nalai; almost all signs found were associated with mineral licks or tracks to them (Boonratana 1998b).

Site: 122, **Dong Phou Vieng**, Savannakhet Province

Locator: ca. 16°26'N, 106°58'E

Tiger Conservation Unit No: none

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: unspecified signs

Last positive information: 1997

Notes. In April-June 1997, elephants were reported as extirpated in many areas but still present around Dong Lai, outside the southern border, and in the Phou Lapeung sector. Signs were seen over an extensive area of the latter of two small herds, including young, and of single individuals (Steinmetz 1998a, Steinmetz and Baird 1997).

Site: 123, **Xe Sap**

Locator: 15°56'-16°19'N, 106°41'-107°28'E

Tiger Conservation Unit No: 106 / 107

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: report

Last positive information: 1997

Notes. Villagers from Somoy reported that the species had been present formerly, but no recent encounters were related (Timmins and Vongkhamheng 1996a). Schaller and Bounsou (1996) also received reports that elephants had contracted in range; they had not been seen in the cultivated areas of Ban Pihai for six years and of Ban Kava for 10 years. Current distribution appears to be patchy: in late 1997, they were reported to be abundant in the north-central area, to have declined severely in the northeast, and to be unrecorded since the mid-1970s in the southwest (R. Steinmetz *in litt.* 1998). Villagers from Ban Aluk said that there were no elephants nearby but that a herd of about 30 lived well within the NBCA. Villagers from Ban Angouas saw tracks of a herd of about 12 northwest of the village in the wet season of 1994 or 1995; in the same season of 1997, they found tracks of only three. These animals occasionally ate standing rice. At Ban Taleuy Gnai, one elephant was believed to come to feed in the cultivated areas each wet season. Villagers from Ban Proy reported occasional sightings of the 20-30 on Phou Leung. Poaching, at least partly by Vietnamese, poses a serious threat (Showler *et al.* 1998a). The Provincial Agriculture and Forestry Office reported that elephants (only 6-7 head) were present in the province only in the north, near the boundary with Salavan Province (K. Khounboline verbally 1998).

Site: 124, **Dong Sithuane**

Locator: ca. 16°05'N, 105°55'E

Tiger Conservation Unit No: 104

Protection status: former proposed protected area

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. Reported to be present (Phanthavong and Santiapillai 1992), Venevongphet 1992).

Site: 125, **Nong Boua**

Locator: ca. 15°50'N, 106°45'E

Tiger Conservation Unit No: none

Protection status: former proposed protected area

Level of evidence: provisional

Class of evidence: not specified
Last positive information: unknown
Notes. Reported present (Venevongphet 1992).

Site: 126, Xe Bang-Nouan

Locator: 15°44'-16°01'N, 105°53'-106°18'E
Tiger Conservation Unit No: 104
Protection status: National Biodiversity Conservation Area
Level of evidence: confirmed
Class of evidence: footprints, report
Last positive information: 1997

Notes. The few signs found in May-July 1995 were mostly of singles or small groups, and came mainly from the Central hills and larger peripheral mountains (Timmins and Bleisch 1995). In October 1997, villagers reported that a herd estimated variously as eight or twenty appeared in the south-centre of the reserve, about 4 km from Ban Khanteuy; reportedly they walked down the Xe Bang-Nouan river from the northeast of the reserve. The group contains at least two tusked males and one infant (R. Dechaineux verbally 1998).

Site: 127, Phou Xiang Thong

Locator: 15°19'-56'N, 105°25'-47'E
Tiger Conservation Unit No: 122
Protection status: National Biodiversity Conservation Area
Level of evidence: confirmed
Class of evidence: footprints
Last positive information: 1997

Notes. Old footprints were seen in the Houay Dua catchment, about 3 km east of Ban Hatxeno, in early 1996; villagers reported that only two animals remained in that area, and that they were the only ones known from the NBCA; those reported by other informants as visiting a saltlick south of Ban Kham-I may therefore be the same, but this needs to be confirmed (Evans *et al.* 1996a). A single elephant was reported still to remain in mid 1997; it was reputedly shot at, as it had been some years previously (K. P. Berkmüller verbally 1998).

Site: 130, Phou Theung

Locator: 15°25'-54'N, 106°29'-51'E
Tiger Conservation Unit No: none
Protection status: proposed National Biodiversity Conservation Area
Level of evidence: provisional
Class of evidence: report
Last positive information: unknown

Notes. Village reports, presumably from a February 1994 visit to seven villages (Berkmüller *et al.* 1995a). Reported by villagers to Bergmans (1995) from "Ban Loy-Nua" along the centre of the area's border.

Site: 131, Tha Teng

Locator: ca. 15°25'N, 106°20'E
Tiger Conservation Unit No: 108
Protection status: former proposed protected area
Level of evidence: provisional
Class of evidence: not specified
Last positive information: unknown
Notes. No details given (Venevongphet 1992).

Site: 132, Dakchung Plateau

Locator: ca. 15°20'N, 107°10'E

Status and conservation of very large mammals in Indochina

Tiger Conservation Unit No: 110

Protection status: part former proposed protected area

Level of evidence: confirmed

Class of evidence: dung

Last positive information: 1997

Notes. Reported to be present by the only village interviewed in the area of the Xe Kong pine forest proposed protected area by Salter (1992b). Although Bergmans (1995), Schaller (1995) and Timmins and Vongkhamheng (1996a) all concluded that elephants were perhaps extinct on the plateau, six piles of dung were found along 2 km of road between Ban Dhone Phak and Ban Daklan in late 1997. Several independent local sources clearly stated that there were no tamed elephants in the area. They reported that two groups live in the area roughly midway between Dong Ampham and Xe Sap NBCAs. One group contains about 12 elephants, including a male with very long tusks and a white elephant, and the other at least eight. A lot of damage to rice and corn crops was caused during December 1997. Two rice store buildings 30 km west of Dakchung were broken into. Elephants first appeared in this area three years ago; local belief is that they came from Sanxay district to the south. Poaching in the area seems to be a threat (Showler *et al.* 1998a; W. G. Robichaud verbally 1998).

Site: 134, **Bolaven Northeast** (= Phou Kateup)

Locator: 15°00'-24'N, 106°23'-49'E

Tiger Conservation Unit No: 108

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: dung, footprints, feeding damage, report

Last positive information: 1994

Notes. Observed dung, tracks and feeding signs in 1995 were old; villagers from Ban Tagneuksua stated that animals occurred in dozens and seasonally, visiting most often in the rainy season (WCS 1995d).

Site: 135, **Bolaven Southwest** (= Phou Luang)

Locator: 14°42'-15°06'N, 106°21'-39'E

Tiger Conservation Unit No: 113

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: dung, footprints, report

Last positive information: 1994

Notes. Villagers reported in 1995 a group of up to 10 animals year-round on hill slopes west of Ban Don Kong and a group of 10 or more seasonally visiting the area between Ban Nong Hin and Ban Hinlat, in the Nong Nyai area; tracks and dung several months old were seen in the latter (WCS 1995d).

Site: 136, **Xe Khampho**

Locator: 14°35'-15°00'N, 106°11'-35'E

Tiger Conservation Unit No: 113

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Recorded during some of 19 village interviews (Berkmüller *et al.* 1995a)

Site: 137, **Phou Kathong**

Locator: 14°54'-15°19'N, 106°47'-107°14'E

Tiger Conservation Unit No: none

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: dung, footprints, report

Last positive information: 1996

Notes. Village reports, presumably from a February 1994 reconnaissance of ten villages (Berkmüller *et al.* 1995a). In January and April-May 1997 various information was gathered. A group lives north of Ban Hin Dam, reportedly crossing into Dong Ampham NBCA in the dry season. Faeces were found at Pong Daeng mineral lick in early January; villagers reported the visit had been two weeks earlier and involved about 17 animals. Some lived around Ban Done Khene-Nyai "2-3 years ago" but reportedly left to escape hunting pressure. Hunting apparently does not involve local people; Vietnamese involvement was claimed. Some crop damage occurs during wet season-dry season movements (Davidson *et al.* 1997).

Site: 138, **Dong Ampham**

Locator: 14°38'-15°18'N, 107°08'-39'E

Tiger Conservation Unit No: 113

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints, report

Last positive information: 1996

Notes. A large area of trampled vegetation was seen south of the Xe Xou river in about 1994 (W. Gadoury verbally 1998). A few elephants were reported to persist just north of the Xe Kaman, near Ban Hindam (Schaller 1997b). In January and April-May 1997, a group of 10 was reported to spend the late wet season in the areas north of Ban Keng Maw (Xe Xou lowlands). Old tracks of at least five were found in that area. They apparently retreat into the central-northern hills in the dry season. Another group of 5-7 was reported to frequent a bamboo-dominated area close to the Cambodian border, south of the NBCA. Hunting apparently does not involve local people; Vietnamese involvement was claimed. Some crop damage occurs during wet season-dry season movements (Davidson *et al.* 1997).

Site: 139, **Nam Ghong**

Locator: ca. 14°30'N, 107°00'E

Tiger Conservation Unit No: 113

Protection status: Provincial Protected Area; former proposed protected area

Level of evidence: confirmed

Class of evidence: dung, footprints etc.

Last positive information: 1998

Notes. Reported to occur in parts of the area until about 1987 (Wikramanayake and Dillon 1997); Schaller (1997b) in 1997 gathered recent reports of small numbers in the headwaters of the Nam Ghong and in hills about 15 km west of Ban Makteo, and found dung along the Nam Ghong (presumably from a herd roaming northeast of Ban Makteo, moving south across the Nam Ghong during the rainy season). Dung and footprints (of varying ages, some only a few days old) were widespread, in at least eight localities, in early 1998 (Fernando in prep.; R. J. Tizard *in litt.* 1998).

Site: 140, **Dong Hua Sao**

Locator: 14°50'-15°11'N, 105°55'-106°18'E

Tiger Conservation Unit No: 113

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: 1997

Notes. Local reports in 1993 and 1997 indicated that odd animals still occasionally visit the very dry forest over towards the Xe Khampho river, an area little frequented by people, but it is unlikely that a resident population persists (Duckworth *et al.* 1994, K. P. Berkmüller verbally 1998). It is not clear whether Salter's (1993a, but based on information from the previous five years) assessment of the NBCA as within an important area for elephants was a misinterpretation of village information, or if

Status and conservation of very large mammals in Indochina

the species declined there in the early 1990s.

Site: 141, **Xe Pian**

Locator: 13°55'-14°47'N, 105°54'-106°29'E

Tiger Conservation Unit No: 113

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints etc.

Last positive information: 1997

Notes. Very fresh tracks and dung of a herd of 10 elephants were found at a saltlick on the Xe Kong plains in April / May 1991 and old tracks of a single animal were found between the Houay Lekfai and Houay Chanang (Dong Kalo) in mid 1992 (Cox *et al.* 1992a). Two single animals and two dung piles were found in the Main Block during November 1992-February 1993; large amounts of dung and other signs, several weeks old at least, were found at a complex of saltlicks in May 1993. Villagers reported that over 100 animals used the area (Duckworth *et al.* 1994). Villagers reported in 1997 that 20-60 lived in the central-western part of the NBCA, but that elephants have declined more severely than has any other large mammal. A map shows evidence of elephants as being widespread, but the text directly contradicts this. The only direct evidence from the survey appears to be tracks of a single, and an old jawbone, in the southern part of the Main Block and 10-day old signs of a small herd at the Houay Kua saltlicks. There are no significant problems with crop-raiding, poaching levels have dropped (one female was poached in 1996) and elephant capture operations from Ban Phapho have ceased (WWF/Burapha 1997).

Site: 142, **Dong Khanthung**

Locator: 14°07'-32'N, 105°12'-45'E

Tiger Conservation Unit No: 122

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: remains in field, footprints etc.

Last positive information: 1997

Notes. Reported by all villages interviewed; several herds numbering between a few and 20 individuals involved, and inhabiting the area south of Ban Houayxai / Ban Kadian. Recent increase claimed by some villagers and attributed to pressure in Cambodia. Abundant old tracks seen along several km of road north of Ban Kanluan. Crop raiding was reported by all villages (Berkmüller and Vilawong 1996). Large numbers of signs were found, given the brevity of the April-May 1996 survey, by Timmins and Vongkhamheng (1996b): old signs were found scattered throughout the Nong Laha area and fresh signs were found along 2 km of road southeast of Ban Po. Reported by villagers to be abundant around Ban Tahin (= Ban Kanluang); an animal heard along the Houay Phak, tracks of four animals seen south of Ban Pho and tracks (probably old) seen west and north of Ban Tahin (ICF 1996). Regularly reported throughout the proposed NBCA, but rare north of the boundary; villagers perceive a recent increase in numbers and attribute it to increased hunting in Cambodia. Skeletal remains of two were found near the Border Nongs, and old tracks were numerous along the logging road near the Xe Lamphao. At least two were heard 6 km southeast of Ban Po on 2 and 3 April 1997. Results of all surveys suggest that the gallery forest north of the Houay Phak / Houay Vian confluence southeast of Ban Po is one of the most important areas for elephants in the proposed NBCA (Wolstencroft in prep.). In early 1998, tracks and faeces were found in many areas visited. Considerable detail is given in the report; briefly, the importance of the Ban Tahin area was re-confirmed and the presence of signs from the previous wet season, coupled with village reports indicated a wide wet-season range east to within 13 km of the Mekong, north to Ban Kadian and west as far as Nong Laha at least. Numbers in the remote west decreased greatly during the military conflicts in the 1980s. Many of the signs were of single individuals and the total population was estimated at about 30-40 (Round and Vongkhamheng 1998).

Cambodia

Site: 150, **Virachey**

Locator: ca. 14°30'N, 107°10'E

Tiger Conservation Unit No: 113

Protection status: National Park

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1997

Notes. Reports of hunting gathered in 1996 by Desai and Lic Vuthy (1996). Not found near O'Lalay, no longer near Phum Koh Pang Leu either (Wikramanayake and Dillon 1997). Tracks seen in the northeast of the park, 3 km from the Vietnam border in January 1998 (J. Fraley verbally 1998). Extensive questioning of locals suggested that there may no longer be any resident elephant herds in Virachey, although passing animals occur: three were seen in the savannah at the headwaters of the Siem Pang river and ten were seen in the upper O'Lalay, near the abandoned village of Veang Kham, in 1997. A herd of 30 was reportedly seen at saltlicks on the Ta Pok river plain in about 1993 but the area has subsequently been converted to plantations (Weiler 1998a). Only small relict numbers remain primarily in the Taveng and Siem Pang (q.v. for area to west) sectors (Heng Kimchhay *et al.* 1998).

Site: 151, **Siem Pang**

Locator: ca. 14°20'N, 106°30'E

Tiger Conservation Unit No: 113

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. The area was believed to hold an important population until recently (Lic Vuthy verbally 1997). However, pressure is intense: 90% of wildlife products coming through Stung Treng originate in this district (S. Phillip verbally to Weiler 1998a) and only few small remnant numbers may persist (Heng Kimchhay *et al.* 1998).

Site: 152, **Phnom Voene**, Ratanakiri Province

Locator: ca. 14°00'N, 106°45'E

Tiger Conservation Unit No: 113

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: 1998

Notes. Reported by villagers to have been common until 1985, and last seen in 1993, except for a lone female seen near Phnom Colapouk in February 1998 (Weiler 1998b).

Site: 153, **O'Chum** District, Ratanakiri

Locator: ca. 14°00'N, 107°15'E

Tiger Conservation Unit No: 113

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported in 1997 from Tapean forest (Bann 1997). Based on the interview results summarised in Heng Kimchhay *et al.* (1998), it seems unlikely that this area supports sizeable numbers of the species.

Site: 154, **Bor Keo** District, Ratanakiri Province

Locator: ca. 13°50'N, 106°50'E

Status and conservation of very large mammals in Indochina

Tiger Conservation Unit No: 113

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Record is merely listed in table (Emerson 1997). Based on the interview results summarised in Heng Kimchhay *et al.* (1998), it seems unlikely that this area supports the species regularly.

Site: 155, **O'Ta Pok**, Ratanakiri

Locator: 14°07'N, 107°14'E

Tiger Conservation Unit No: 113

Protection status: 113

Level of evidence: confirmed

Class of evidence: report

Last positive information: 1995

Notes. A herd of about 30 was seen from a helicopter about 15-18 km ENE of Taveng village, east of the O'Ta Pok stream during February-April 1995 (per A. Maxwell *in litt.* 1998).

Site: 156, **North and west of Ban Lung**, Ratanakiri Province

Locator: 13°39-54'N, 106°43-51'E

Tiger Conservation Unit No: 113

Protection status: none

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1996?

Notes. Two old trails (one from a single, the other from a group of three) were found along the 99 km walked in May-June 1996, indicating a very low population; locals indicated that the species had previously been common (Desai and Lic Vuthy 1996). Based on the interview results summarised in Heng Kimchhay *et al.* (1998), it seems unlikely that this area still supports the species regularly.

Site: 160, **Tonle Sap**

Locator: ca. 13°20'N, 103°30'E

Tiger Conservation Unit No: none

Protection status: UNESCO Biosphere Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Use of the flooded forest around much of the lake by elephants used to be fairly frequent until 30-40 years ago, but is now very rare. An instance of a herd entering from forest to the north, involving crossing agricultural land in Kompong Thom, occurred in the 1990s (N. Thayer per D. Ashwell verbally 1998).

Site: 161, **Lomphat**

Locator: ca. 13°20'N, 107°10'E

Tiger Conservation Unit No: 113

Protection status: Wildlife Sanctuary

Level of evidence: provisional

Class of evidence: report

Last positive information: 1988

Notes. A. Maxwell (*in litt.* 1998) was told in the mid 1990s by an elephant driver that no wild elephants remained in the district, although they had been common in the past (his was taken in 1956). Local people told Desai and Lic Vuthy (1996) that elephants were not common and although none had been seen in recent years, some might persist in the centre. Prior to 1988, elephants were seen regularly, but since then poaching had largely wiped the species out. Small numbers were

reported to persist in the sector south of the Srepok (Heng Kimchhay *et al.* 1998).

Site: 163, **Bouvel** District, northwest Battambang Province

Locator: ca. 13°05'N, 102°35'E?

Tiger Conservation Unit No: 125

Protection status: none

Level of evidence: confirmed

Class of evidence: report, remains (location?)

Last positive information: 1997

Notes. A herd of 20 was reported by the Provincial Forest Department in June 1997 (Sun Hean verbally 1998). Two were killed by soldiers in early 1997; the meat was seen by the informant and 5-6 animals were estimated to remain (Sim Paat verbally 1998). Hunters' reports gathered in 1998 from an extensive area of the province suggested only small numbers remained (Heng Kimchhay *et al.* 1998).

Site: 164, **Northeast Mondulakiri** Province

Locator: ca. 13°00'N, 107°25'E

Tiger Conservation Unit No: 113

Protection status: none

Level of evidence: confirmed

Class of evidence: footprints, seen, remains in field

Last positive information: 1995

Notes. Along the border with Ratanakiri Province, over 100 elephants were reported in about 1993 by UNTAC staff (D. Ashwell verbally 1998); however the basis for this is not clear and such numbers have not been suggested by any other recent work. "All" waterholes checked in a small area of Mondulakiri were reported to have elephant footprints (Dioli 1994), but the basis for assessment as wild is not given; the area is believed to be to the west and south of the Srepok from the Vietnamese border. Two animals and 22 sets of footprints were found in 155 km of survey between Senmonorom and the Srepok river in June 1995, but it is unclear what proportion relate to wild animals (Sun Hean 1995a); an estimate is later given of 22 animals for the area; three de-tusked elephant skulls were found (Sun Hean 1995b). Wild animals also reported in the north of this area, round Phnom Yangke and Yang Por, by Lic Vuthy (*in litt.* 1998). To the north of the Srepok recent reports of occasional visits were gathered in 1998 (Heng Kimchhay *et al.* 1998).

Site: 165, **East Mondulakiri** Province

Locator: 12°33-59'N, 107°21-32'E

Tiger Conservation Unit No: 113

Protection status: none

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1996

Notes. No animals were seen during an aerial survey in March 1994, despite advance reports of 200-400 in the area (Olivier and Woodford 1994). There were four records of fresh tracks of elephants over the 223 km walked in April-May 1996, indicating that they are extremely rare. Two related to solo animals, the others to herds of two, and of 4-5. A further two fresh tracks were probably repeat counts. Only seven old trails were found. Villagers corroborated that elephants are now rare in the area (Desai and Lic Vuthy 1996). As elephants are used for forays into remote areas (Desai and Lic Vuthy 1996: 19), it is even possible that some of these few signs do not refer to wild animals.

Site: 166, **Phnom Prich**

Locator: ca. 12°30'N, 107°10'E

Tiger Conservation Unit No: 113

Protection status: Wildlife Sanctuary

Level of evidence: provisional

Status and conservation of very large mammals in Indochina

Class of evidence: reported

Last positive information: 1994

Notes. Hunters' reports suggested that this part of Mondulkiri Province had the greatest numbers of large mammals but even here numbers are small and dispersed (Heng Kimchhay *et al.* 1998).

Site: 167, **Pursat Province**

Locator: ca. 12°20'N, 103°30'E

Tiger Conservation Unit No: 125?

Protection status: none

Level of evidence: confirmed

Class of evidence: report

Last positive information: unknown

Notes. A report of over 200 in the province coinciding with the return of the king to Cambodia in November 1992 could perhaps best be interpreted as over-zealous patriotism (D. Ashwell verbally 1998), but the province forms much of the area identified through interviews by Heng Kimchhay *et al.* (1998) as supporting the most important national Asian Elephant population, with "an incredible 29 out of 31 Koh Kong / Pursat hunters report[ing] high elephant densities".

Site: 168, **Phnom Nam Lyr**

Locator: ca. 12°20'N, 107°50'E

Tiger Conservation Unit No: 113

Protection status: Wildlife Sanctuary

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. Reported as present, no detail given (Desai and Lic Vuthy 1996). Hunters' reports suggested that small numbers may possibly remain (Heng Kimchhay *et al.* 1998).

Site: 169, **Snoul**

Locator: ca. 11°50'N, 107°00'E

Tiger Conservation Unit No: 113

Protection status: Wildlife Sanctuary

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Commonly traded in the region and by May 1996 much scarcer (Nhiel Thorn and Be Seng Leang 1996). The small sector in Keo Sema District (Mondulkiri) and land outside the sanctuary to the east and north were reported to retain high densities in 1998 (Heng Kimchhay *et al.* 1998).

Site: 170, **Phnom Aural**

Locator: ca. 11°40'N, 104°05'E

Tiger Conservation Unit No: 125

Protection status: Wildlife Sanctuary

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported by local people and / or soldiers, but information needs checking (Chay Samith verbally 1998). Based on the interviews summarised in Heng Kimchhay *et al.* (1998), it is quite plausible that this area still supports the species regularly in large numbers.

Site: 172, **Kirirom**

Locator: ca. 11°05'N, 104°00'E

Tiger Conservation Unit No: 125

Protection status: National Park

Elephant records: Cambodia

Level of evidence: extinct?

Class of evidence: report

Last positive information: unknown

Notes. Elephants were reported, if present at all, to number under 20 (Lay Khim and Taylor-Hunt 1995); Chay Samith (verbally 1998) doubts that any are present.

Site: 173, **Phnom Bokor**

Locator: ca. 10°30'N, 104°00'E

Tiger Conservation Unit No: 125

Protection status: National Park

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1998

Notes. A herd of 10 was seen in oil palm to the northwest of the park in early January 1998 (Mong Reththy per Chay Samith verbally 1998). In early 1997, prints were found easily in the park; a year later, signs are seen much less frequently (K. W. Sorensen verbally 1998). Nonetheless F. Goes (*in litt.* 1998) found signs on the plateau in February and May 1998.

Site: 174, **Ream** (Preah Sihanouk)

Locator: ca. 10°20'N, 103°30'E

Tiger Conservation Unit No: 125

Protection status: National Park

Level of evidence: confirmed

Class of evidence: report

Last positive information: 1997

Notes. Reported to have disappeared by DNCP (1995) but in late 1997 a herd of 10 crossed and damaged crops about 11-12 km east of Sihanoukville and north of the main highway. This an unusual occurrence perhaps resulted from intensified disturbance from logging to the north of the sighting area. Villagers shot at them but it is unclear if any were killed (P. Im verbally 1998).

Site: 175, **Sam Lot** District, Battambang Province

Locator: not traced

Tiger Conservation Unit No: not known

Protection status: not known

Level of evidence: confirmed

Class of evidence: report

Last positive information: unknown

Notes. A young elephant was caught and sold to Thailand via Pailin in 1997. Other animals are rumoured to remain (Sim Paat verbally 1998).

Site: 176, **Kom Mum**, Ratanakiri Province

Locator: ca. 13°30'N, 106°40'E

Tiger Conservation Unit No: 125

Protection status: none

Level of evidence: confirmed

Class of evidence: dung

Last positive information: 1998

Notes. A dung bolus was found near the O'Quey in mid 1998; locals were adamant that it was from a wild animal, and said two lived in the area. In view of the survey effort, it is clear that the area does not regularly hold the species (Timmins in prep.). Note: out of latitudinal sequence and not mapped as information freshly received after map produced.

Yunnan Province, China

Site: 183, **Tongbianguan**, Yingjiang County

Locator: 24°30'N, 97°30'E

Tiger Conservation Unit No: not applicable

Protection status: not known

Level of evidence: extinct?

Class of evidence: not applicable

Last positive information: not applicable

Notes. The area supported elephants into the 1980s but by 1986 all had gone. Animals moved between Yunnan and Burma (Wang Yingxiang verbally 1998).

Site: 185, **Wei Yuan Jiang**, Jing Gu County

Locator: 23°30'N, 100°50'E

Tiger Conservation Unit No: not applicable

Protection status: Provincial Nature Reserve

Level of evidence: provisional

Class of evidence: not applicable

Last positive information: not applicable

Notes. Reported by local foresters in 1995 (Wang Weimin verbally 1998).

Site: 186, **Nanguanhe**, Cang Yuan County

Locator: 23°20'N, 90°00'E

Tiger Conservation Unit No: not applicable

Protection status: National Nature Reserve

Level of evidence: confirmed

Class of evidence: not applicable

Last positive information: not applicable

Notes. This site holds about 18 animals, having increased from 14 in the early 1980s; they sometimes cross into Burma but live mostly within Yunnan (Wang Yingxiang verbally 1998). The local estimate of 30 (Wu Zhaolu verbally 1998) is probably too high. There are apparently no problems with poaching (Wang Yingxiang verbally 1998) or other killing, although crop damage is frequent (Wang Weimin verbally 1998).

Site: 188, **Ximeng** County

Locator: ca. 22°50'N, 99°30'E

Tiger Conservation Unit No: not applicable

Protection status: not known

Level of evidence: provisional

Class of evidence: not applicable

Last positive information: not applicable

Notes. Ten were estimated in 1987 (Zu Zaifu 1987 in Santiapillai and Jackson 1990) but no more recent information was located.

Site: 189, **Zulin**, Simao Country

Locator: ca. 22°45'N, 100°30'E

Tiger Conservation Unit No: not applicable

Protection status: part Provincial Nature Reserve (1997 on)

Level of evidence: provisional

Class of evidence: not applicable

Last positive information: not applicable

Notes. About ten animals occur irregularly, but annually, in the area, presumably as wanderers from Xishuangbanna NNR (q.v.) (Wang Weimin verbally 1998).

Elephant records: Yunnan Province, China

Site: 190, **Simao airport**, Simao Country

Locator: not located

Tiger Conservation Unit No: not applicable

Protection status: none

Level of evidence: extinct?

Class of evidence: not applicable

Last positive information: not applicable

Notes. In 1996 one appeared and was fed (e.g. sugar cane, bread) by the locals. It moved on to Jinggu County and then Pu Et County. In the latter it was captured as by this time it had killed at least one person and attacked several others; it still lives, as a captive, in Mengyang (Wang Weimin verbally 1998).

Site: 191, **Lancang** County

Locator: ca. 22°30'N, 100°00'E

Tiger Conservation Unit No: not applicable

Protection status: not known

Level of evidence: provisional

Class of evidence: not applicable

Last positive information: not applicable

Notes. Twenty were estimated in 1987 (Zu Zaifu 1987 in Santiapillai and Jackson 1990) but no more recent information was located.

Site: 192, **Jiangchung** County

Locator: 22°30'N, 101°55'-102°15'E

Tiger Conservation Unit No: not applicable

Protection status: not known

Level of evidence: confirmed

Class of evidence: not applicable

Last positive information: not applicable

Notes. The area supports about 40 elephants in two herds. They live mostly in Lao and visit Yunnan irregularly: they occurred in Yunnan in 1994 (when one group of 28 visited) and 1995, but did not cross the border in the subsequent two years. The group sizes and timing of occurrence are based on local information (Wang Yingxiang verbally 1998). Such large numbers have not recently been noted from either Phou Dendin NBCA or the Nam Khang area (q.v.).

Site: 193, **Xishuangbanna**

Locator: 21°09'-22°36'N, 99°58'-101°50'E

Tiger Conservation Unit No: not applicable

Protection status: National Nature Reserve

Level of evidence: confirmed

Class of evidence: not applicable

Last positive information: not applicable

Notes. Most elephants in Yunnan live in the Xishuangbanna NNR. In 1983, elephants were found mainly in Mengla and Shangyong (the two southernmost parcels), with substantial numbers also in Lungman (not one of the named reserve parcels) and Mengyang, and small numbers in Menglum (Yuang Yuan Chang 1992).

The Mengyang parcel formerly held animals in two main areas, but three or even four are now occupied (Wang Yingxiang verbally 1998): the northeast corner; the central east; and the central west (Jiang Wang Gao verbally 1998). A 1997 estimate of 130-140 (itself smaller than reserve staff estimates; Jiang Wang Gao verbally 1998) seems high and 80-120 is a more plausible number (Wang Yingxiang verbally 1998). This is similar to the estimate of Santiapillai *et al.* (1994) for 1991 of 100-120. W. V. Bleisch (*in litt.* 1998) found that signs were still abundant in the area in 1997.

Menglum held in the mid 1990s only three animals (Wang Yingxiang verbally 1998).

Mengla has a total of up to 50-80 in 2-3 areas (Wang Yingxiang verbally 1998), but many or all

Status and conservation of very large mammals in Indochina

appear to live in Lao; numbers were artificially high in the early 1990s when salt was spread to attract them (Jiang Wang Gao verbally 1998). While in Yunnan, these animals concentrate in the high border mountains (Santiapillai *et al.* 1994).

Shangyong has a total of 30-50 (Wang Yingxiang verbally 1998) in 3-4 groups; some stay in China permanently, some move across the international border (Jiang Wang Gao verbally 1998). The 1991 figure of Santiapillai *et al.* (1994) was, at 130-150, much higher, but was expressly speculative.

Elephants have not been regular in Menghai (west of the Mekong and including Mangao parcel) since the 1950s (Wang Yingxiang verbally 1998); although Santiapillai *et al.* (1994) traced one report of an animal on the west bank of the river, they assumed that it had temporarily dispersed out of Mengyang. They estimated that, despite earlier supposition, there were then no elephants along the Burmese border and probably had not been for 30 years.

There are now apparently no significant numbers resident outside reserves (Wang Yingxiang verbally 1998), although during October-November 1991 Santiapillai *et al.* (1994) gathered evidence of animals in several dozen localities outside the reserve network.

Estimates from 1983 of 100 seemed to be too low, with 250-300 being presented in 1992 as a more accurate estimate (Yuang Yuan Chang 1992). Estimates of prefecture total for 1998 are under 150 (Yu Changqin *in litt.* 1998), 130-180 animals (Wang Yingxiang verbally 1998) or 200 at most, in two main permanent populations, Mengyang and Shangyong (Jiang Wang Gao verbally 1998).

Prior to 1980, movement was frequent between all parcels, but this is no longer so. Those of Mengla and Shangyong frequently cross to Lao, but are isolated from each other by a densely settled and cultivated band of land. The Mengyang herds are largely isolated from all others (Wang Yingxiang verbally 1998), although formerly so much movement occurred between there and Mengla that the area between them, particularly along the Xiaohai river, was regarded as one of three main areas of the prefecture for elephants (Santiapillai *et al.* 1994); a seasonal population of 100 was estimated. Occasional such passage still occurs and the three animals currently in Menglum were probably left behind on one such dispersal. Overall numbers in the reserve have risen quite considerably, but this is probably due more to immigration (as land outside the park has become ever less favourable) than to intrinsic growth (Wang Yingxiang verbally 1998). Nonetheless, breeding is regular; villagers found a very young animal in March 1996 in the northwest of Mengyang and all three herds observed directly in 1997 contained small animals (Jiang Wang Gao verbally 1998).

Annex 3: Gaur records from Indochina

Sites are shown on Fig. 3, numbered as in the text.

Vietnam

Site: 7, **Muong Nhe**, Muong Te / Muong Lay Districts, Lai Chau Province

Locator: 22°00-26'N, 102°10-45'E

Tiger Conservation Unit No: none

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: not specified

Last positive information: 1991

Notes. Although Le Vu Khoi (1995) estimated that Gaur probably numbered more than 150 in 1985, in late 1991 evidence (not specified) of presence was restricted to four localities within the reserve and the surveyors speculated that the species might never have been common as even in the mid-1970s occurrence was assessed as being patchy (Cox *et al.* 1992b). Le Vu Khoi (1995) gave a revised estimate of under 35 for the reserve.

Site: 11, **Sop Cop**, Song Ma District, Son La Province

Locator: ca. 20°41'N, 103°42'E

Tiger Conservation Unit No: none

Protection status: Nature Reserve

Level of evidence: extinct?

Class of evidence: report

Last positive information: unknown

Notes. 17 animals were estimated by local people in 1992 (Le Vu Khoi 1995, verbally 1998) but by 1997 the species probably no longer occurred (Do Tuoc verbally 1998).

Site: 12, **Xuan Nha**, Moc Chau District, Son La Province

Locator: ca. 20°41'N, 104°43'E

Tiger Conservation Unit No: none

Protection status: Nature Reserve

Level of evidence: extinct?

Class of evidence: not specified

Last positive information: unknown

Notes. Part of 150 in Lai Chau / Son La provinces in 1995 (Le Vu Khoi 1995). By 1998 it was questionable if any remained in the province (Do Tuoc verbally 1998).

Site: 14, **Pu Hu**, Thuong Xuan District, Thanh Hoa Province

Locator: ca. 20°25'N, 104°40'E

Tiger Conservation Unit No: 95

Protection status: proposed Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Locals reported about six in 1996 (Do Tuoc verbally 1998).

Site: 15, **Pu Luong**, Thuong Xuan District, Thanh Hoa Province

Locator: ca. 20°15'N, 104°40'E

Tiger Conservation Unit No: 95

Protection status: proposed Nature Reserve

Level of evidence: confirmed

Class of evidence: footprints

Status and conservation of very large mammals in Indochina

Last positive information: 1996

Notes. One was killed in the district by hunters in about 1986. A group of 4-5 were said to inhabit the area (Ha Dinh Duc verbally 1997). Footprints were seen in 1996; locals reported seven in 1996 and four in 1997 (Do Tuoc verbally 1998).

Site: 17, **Pu Hoat**, Que Phong (= Quy Phuong) District, Nghe Anh Province

Locator: ca. 19°45'N, 104°50'E

Tiger Conservation Unit No: 95

Protection status: proposed Nature Reserve

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1994

Notes. Seven animals were estimated by local people in 1993 (Le Vu Khoi 1995, verbally 1998); note that this source calls the site Bu Huong. Footprints were abundant in 1994 and villagers still reported the species in 1997 (Dawson and Do Tuoc 1997; Do Tuoc verbally 1998); note that the former calls the site Thong Thu / Hanh Dich. It is not clear if any remain (Do Tuoc and Le Trong Trai in prep.). A specimen in the Hanoi University Collection taken by Tran Vu in 1972 comes from an unspecified locality in the province.

Site: 18, **Pu (=Bu) Huong**, Que Phong District, Nghe Anh Province

Locator: ca. 19°41'N, 104°42'E

Tiger Conservation Unit No: 97

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Locals reported the presence of the species (Kemp and Dilger 1996).

Site: 19, **Ben En**, Nhu Xuan District, Thanh Hoa Province

Locator: ca. 19°31'N, 105°25'E

Tiger Conservation Unit No: none

Protection status: National Park

Level of evidence: extinct?

Class of evidence: report

Last positive information: unknown

Notes. In December 1992-January 1993 villagers reported that Gaur had been extirpated in about 1975 (Dawson *et al.* 1993). Tordoff *et al.* (1997) indicated that they had received villagers' reports. Do Tuoc and Le Trong Trai (in prep.) felt that the species might be locally extinct.

Site: 21, **Ky Son** District, Nghe Anh Province

Locator: ca. 19°20'N, 104°00'E.

Tiger Conservation Unit No: adjacent to 99

Protection status: none traced

Level of evidence: provisional

Class of evidence: remains in village

Last positive information: unknown

Notes. A skull was seen in a house in Muong Xen, the district town; no indication of age or origin was given (Rozendaal 1990). Do Tuoc (verbally 1998) considers that increased disturbance makes it unlikely that significant numbers survive.

Site: 23, **Pu Mat**, Tuong Duong / Con Cuong / Anh Son Districts, Nghe Anh Province

Locator: 18°40'-19°05'N, 104°25'-105°00'E

Tiger Conservation Unit No: 99

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. A herd of 26 was reported from Yen Na subdistrict (Truong Duong); one shot shortly before survey resulted in prison and fines for all four men concerned. Also reported from the international border of Con Cuong District (Rozendaal 1990). Seven and five animals were estimated for Tuong Duon and Anh Son by local people in 1992 and 1991 respectively (Le Vu Khoi 1995, verbally 1998). Local reports of about 30 in one remote part of the reserve were received in mid 1998 (M. Baltzer verbally 1998).

Site: 24, **Thanh Chuong** District, Nghe An Province

Locator: 18°40'N, 105°20'E

Tiger Conservation Unit No: 99

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. The species was listed (without details) for the district by Do Tuoc and Le Trong Trai (in prep.).

Site: 26, **Vu Quang**, Huong Khe District, Ha Tinh province

Locator: 18°09'-20'N, 105°18'-27'E

Tiger Conservation Unit No: 99

Protection status: Nature Reserve

Level of evidence: confirmed

Class of evidence: feeding damage, footprints, dung

Last positive information: 1994

Notes. Signs were found in 1992 in various areas up to 1200 m (MacKinnon and Vu Van Dung 1992; Do Tuoc verbally 1998). Signs were abundant in 1994 in the southeast of the reserve, near the border with Lao. At least 20 were estimated (Dawson and Do Tuoc 1997); a villagers' estimate of 35 was given by Le Vu Khoi (1995, verbally 1998).

Site: 27, **Ho Ke Go**, Thach Ha, Huong Khe / Cam Xuyen / Ky Anh Districts, Ha Tinh Province

Locator: 18°00'-09'N, 105°50'-106°07'E

Tiger Conservation Unit No: adjacent to 99

Protection status: Nature Reserve

Level of evidence: confirmed

Class of evidence: remains in village, footprints

Last positive information: 1993

Notes. One or more skulls were seen in the possession of local hunters in Ky Anh (Eames *et al.* 1988). A Scandinavian team in 1993 found footprints near Coi Cave. In 1995, the populations seemed to be dispersed and small. Locals reported seeing a group of three and a single in May 1995 near Mui Nhui and near Bac Toc mountain, and informed that numbers had declined severely because of hunting and logging (Le Trong Trai *et al.* 1996b).

Site: 28, **Quang Ninh / Le Thuy** Districts, Quang Binh Province

Locator: ca. 17°10'N, 106°30'E

Tiger Conservation Unit No: 99

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Local reports of the species persist but there has been no survey for over 20 years (Do Tuoc verbally 1998).

Status and conservation of very large mammals in Indochina

Site: 29, **Phong Nha-Ke Bang**, Bo Trach District, Quang Binh Province

Locator: ca. 17°09'N, 106°12'E

Tiger Conservation Unit No: 99

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: report, remains in village

Last positive information: unknown

Notes. Five animals were estimated by local people in 1992 (Le Vu Khoi 1995, verbally 1998; note that this source calls the site Bu Huong). In the Truong Son Enterprise people reported that Gaur had occurred only once, back in 1993; reports also came from Thuong Hoa and specimen(s) (no information on age or provenance) were found at Bar En (Pham Nhat *et al.* 1995). Le Xuan Canh *et al.* (1997a) received reports in 1996-1997 of Gaur and estimated that 20 animals remained in two groups, in Hoa Son and Phong Nha sectors (Appendix 2 states that the species was seen but this is not discussed in the text).

Site: 30, **Dak Krong and Huong Hoa** Districts, Quang Tri Province

Locator: ca. 16°40'N, 106°40'E

Tiger Conservation Unit No: none

Protection status: none traced

Level of evidence: provisional

Class of evidence: report, remains in village

Last positive information: 1997

Notes. In 1998 villagers near the Song Ba Long river, Dak Krong District, reported a herd of 10-19 in an area of secondary forest and grassland. Two trophies in nearby houses had been taken in 1995 and 1997 (Le Trong Trai verbally 1998). Local reports of the species from Huong Hoa District persist but there has been no survey for over 20 years (Do Tuoc verbally 1998).

Site: 32, **Bach Ma**, Phu Loc District, Thua Thien-Hue Province

Locator: ca. 16°11'N, 107°49'E

Tiger Conservation Unit No: 107

Protection status: National Park

Level of evidence: extinct?

Class of evidence: report

Last positive information: 1962

Notes. There were many historical records, the last in 1962 (Rheinart des Essarts 1934, Cadière 1934, Nguyen Huu Dinh 1962), but there is no recent evidence despite considerable search effort (WWF/EC 1997), and a 1993 estimate (by local people) of 35 (Le Vu Khoi 1995; verbally 1998).

Site: 33, **A Luoi / Nam Dong** Districts, Thua Thien-Hue Province

Locator: ca. 16°05'-20'N, 107°15'-30'E

Tiger Conservation Unit No: 107

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. There are recent local reports from one area of the former district and two of the latter (Do Tuoc verbally 1998).

Site: 38, **Tra My** District, Quang Nam Province

Locator: ca. 15°15'N, 108°10'E

Tiger Conservation Unit No: 111

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. 20 were estimated in the province by local people in 1992 (Le Vu Khoi 1995, verbally 1998) and the district may still holding the species (Do Tuoc and Le Trong Trai in prep.).

Site: 40, **Kon Plong** (=Con, Kong Plong) District, Kon Tum Province

Locator: ca. 14°40'N, 108°20'E

Tiger Conservation Unit No: 114

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. There are recent local reports (Do Tuoc verbally 1998).

Site: 41, **Kon Ha Nung**, An Khe District, Gia Lai Province

Locator: ca. 14°30'N, 108°28'E

Tiger Conservation Unit No: 114

Protection status: includes two Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Area incorporates Buon Luoi, Kon Cha Rang NR and Kon Ka Kinh NR; Gaur were recorded in primary forest, concentrated in the latter two areas (Dang Huy Huynh *et al.* 1984). Totals of 25 and 45 were estimated by local people in 1994 in Kon Cha Rang and Kon Ka Kinh respectively (Le Vu Khoi 1995, verbally 1998). Do Tuoc (verbally 1998) also received local reports of continuing presence.

Site: 42, **Chu Mom Ray**, Sa Thay District, Kon Tum Province

Locator: ca. 14°25'N, 107°47'E

Tiger Conservation Unit No: 113

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: footprints, remains (location?)

Last positive information: 1997?

Notes. Two specimens from the district are held at the National University of Hanoi collection (Tran Hong Viet 1990). Dang Huy Huynh *et al.* (1979) listed it on the basis of interviews and documents for the district and the adjacent one of Dak To. A villagers' estimate of 75 was given by Le Vu Khoi (1995, verbally 1998), while local reports suggested a hundred animals in the whole district (Le Trong Trai 1993). Later, Do Tuoc and Ngo Tu (1995) estimated only 30-35 head distributed among 5-6 herds; large numbers were reported to visit the hot springs / saltlick near border guard station 705, near the foot of Chu Chok, near Xop Village. Many prints seen in April 1997 were identified simply as cattle sp.; their number and the absence of domestic cattle in the area suggested strongly that wild cattle had left the prints (Wikramanayake and Dillon 1997; E. Wikramanayake verbally 1997).

Site: 44, **Chu Prong and Duc Co** Districts, Gia Lai Province

Locator: ca. 13°25'N, 107°45'E

Tiger Conservation Unit No: 113

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Occurs in a continuous population with that in Ea Sup District (Do Tuoc and Le Trong Trai in prep.; Do Tuoc verbally 1998); single herds of nine and five were reported from Chu Prong and Duc Co respectively to Le Trong Trai (1993).

Status and conservation of very large mammals in Indochina

Site: 45, **Dong Xuan** District, Phu Yen Province

Locator: ca. 13°25'N, 108°55'E

Tiger Conservation Unit No: none

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Local reports indicated a herd of six (Le Trong Trai 1994).

Site: 46, **A Yun Pa** (= Ajun Ba, Iajunba, A Yunba) District, Gia Lai Province

Locator: ca. 13°20'N, 108°30'E

Tiger Conservation Unit No: 117

Protection status: none traced

Level of evidence: extinct?

Class of evidence: not specified

Last positive information: unknown

Notes. Possibly present formerly (about 1980) but the area is now badly degraded and Gaur are unlikely to persist (Do Tuoc verbally 1998).

Site: 47, **Ea Sup** District, Dak Lak Province

Locator: 13°00'-20'N, 107°35'-108°00'E

Tiger Conservation Unit No: 113

Protection status: proposed extension to National Park

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1997

Notes. Footprints were abundant in 1986 (Le Vu Khoi verbally 1998), but only 12 were reported by local people to remain in 1993, and that would include any animals in today's Ban Don District (Le Trong Trai 1993). See Yok Don NP for information from Dang Zui Khun *et al.* (1991). Old footprints were found in the western part of Ya Lop, and one fresh trail in the eastern part of Chu Mulanh, in mid 1997. At least two were shot in the area in 1995-1996 (Le Xuan Canh *et al.* 1997b). The clear decline in Yok Don (q.v.) has doubtless occurred here too.

Site: 48, **Yok Don**, Ban Don District, Dak Lak Province

Locator: 12°45'-13°00'N, 107°29'-50'E

Tiger Conservation Unit No: 113

Protection status: National Park

Level of evidence: confirmed

Class of evidence: seen, footprints etc.

Last positive information: 1997

Notes. Three groups were seen in one month's work, December 1986, two of 15-25 in the Dak Nar / Dak Nor area, and one of 8-10 near Yok Don hill; all three were flushed from daytime rest areas (Le Vu Khoi verbally 1998); these apparently overlap with the five groups reported to Hedges (in prep.) for March-April 1987. The density estimated from work in the Srepok basin (thus, some in Ea Sup, q.v.) in 1986-1987 was of 312±130 in 612.5 sq. km (Dang Zui Khun *et al.* 1991). Footprints were widespread in the west and centre of the park in April 1989 but were less common than were Banteng's (Laurie *et al.* 1989). Cox and Ha Dinh Duc (1990) found fresh signs near the Dak Na in October 1990 and tracked (unsuccessfully) a herd of five. The park population was estimated as 95 (by villagers) in 1993 (Le Vu Khoi 1995, verbally 1998). Footprints were seen near Yok Don hill and near Yok Da in February-March 1995; three groups (totalling 39 individuals) were reportedly seen in late 1995 or in 1996 (Dang Huy Huynh *et al.* 1995a, 1997). Old footprints were found in the western part of the area surveyed in 1997, but the lack of fresh prints suggests a major decline; this was corroborated by villagers. At least two were reported to be poached in 1995-1996 (Le Xuan Canh *et al.* 1997b).

Site: 49, **Krong Trai** (formerly Suoi Trai), Son Hoa District, Phu Yen Province

Locator: ca. 13°00'N, 108°45'E

Tiger Conservation Unit No: none

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Local reports indicated in 1990 that there were three groups totalling 25-30 head, but heavy hunting caused a major decrease by 1994 (Le Trong Trai 1994).

Site: 50, **Song Hinh** District, Phu Yen Province

Locator: ca. 12°55'N, 108°55'E

Tiger Conservation Unit No: none

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Local reports indicated a herd of five (Le Trong Trai 1994).

Site: 51, **Ea So** Commune, Ea Kar District, Dak Lak Province

Locator: 12°49'-13°01'N, 108°31'-44'E

Tiger Conservation Unit No: 118?

Protection status: proposed Nature Reserve

Level of evidence: confirmed

Class of evidence: seen, footprints

Last positive information: 1997

Notes. A herd of five was reported to remain somewhere in Ea Kar District to Le Trong Trai (1993). Fresh footprints were found regularly during April-May 1997 over most of the area surveyed; old footprints were found even more widely. Animals were seen 2-3 times, in groups of eight, four (including two young) and at least one (the last was not confirmed as this species). At least four were shot in the area in 1995-1996 (Le Xuan Canh *et al.* 1997b).

Site: 54, **Chu Yang Sin**, Lak / Krong Bong Districts, Dak Lak Province

Locator: 12°14'-31'N, 108°17'-35'E

Tiger Conservation Unit No: 120

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: unspecified signs

Last positive information: 1994

Notes. Twelve were reported to remain in Lak District to Le Trong Trai (1993). Fresh signs were found along the Ea K'Tour in January 1994 (Eames and Nguyen Cu 1994); the species is now rare (Le Trong Trai *et al.* 1996a).

Site: 55, **Nam Nung**, Dak Mil (= Dak Min) District, Dak Lak Province

Locator: ca. 12°16'N, 107°45'E

Tiger Conservation Unit No: 113

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. May still occur; a recent staff survey provisionally identified the species from local reports (Do Tuoc verbally 1998), and there are earlier local reports of two herds totalling 15, and a further herd of nine in adjacent Cu Jut District (Le Trong Trai 1993).

Status and conservation of very large mammals in Indochina

Site: 56, **Nam Ka**, Krong No District, Dak Lak Province

Locator: ca. 12°15'N, 107°55'E

Tiger Conservation Unit No: 113

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. A herd of 12 animals reported to Le Trong Trai (1993); may still occur (Do Tuoc verbally 1998).

Site: 57, **Ta Dung** (formerly Quang Xuyen), Dak R'Lap District, Dak Lak Province

Locator: ca. 12°10'N, 107°30'E

Tiger Conservation Unit No: 113

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Gaur was listed for the area by Dang Huy Huynh *et al.* (1980); 35 were estimated by local people in 1993 (Le Vu Khoi 1995, verbally 1998). Still possibly persisting in 1997 (Do Tuoc and Le Trong Trai in prep.).

Site: 58, **Bu Gia Map**, Phuoc Long District, Binh Phuoc Province

Locator: ca. 12°09'N, 107°08'E

Tiger Conservation Unit No: 113

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. 45 were estimated by local people in 1992 (Le Vu Khoi 1995, verbally 1998) and the area still reportedly supports the species (Pham Trong Anh and Pham Mong Giao per Do Tuoc verbally 1998).

Site: 59, **Bi Doup Nui Ba** (formerly Thuong Da Nhim), Lac Duong District, Lam Dong Province

Locator: ca. 12°04'N, 108°14'E

Tiger Conservation Unit No: 120

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: unspecified signs

Last positive information: 1993

Notes. Ten animals were estimated by local people in 1990 (Le Vu Khoi 1995, verbally 1998). Two herds of 17-20 were reported from the whole district to Le Trong Trai (1993). Villagers from Long Lanh reported small numbers far from the village in bamboo forest; fresh signs were found in late 1993 near Hill 1978 and on the banks of the upper Da Nhim (Eames and Nguyen Cu 1994). Four specimens at the Da Lat Biological Sub-institute probably came from the province (Pham Trong Anh *et al.* 1996), but no more precise information is available.

Site: 60, **Dak Nong** District, Dak Lak Province

Locator: ca. 12°00'N, 107°45'E

Tiger Conservation Unit No: 113

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Two herds totalling 15 reported to Le Trong Trai (1993).

Site: 61, **Ninh Son / Ninh Phuoc** Districts, Ninh Thuan Province

Locator: ca. 11°30'-12°00'N, 108°40'-50'E.

Tiger Conservation Unit No: adjacent to 120

Protection status: none traced

Level of evidence: confirmed

Class of evidence: remains (location?), report

Last positive information: unknown

Notes. Local reports were gathered and a skull was seen during a 1997 survey (Do Tuoc and Le Trong Trai in prep.; Do Tuoc verbally 1998); near to Bidoup Nui Ba and Chu Yang Sin areas (q.v.).

Site: 62, **Loc Ninh** District, Binh Phuoc Province

Locator: ca. 11°50'N, 106°30'E.

Tiger Conservation Unit No: 113

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Hunters reported many Gaur in 1992 (Do Tuoc verbally 1998).

Site: 63, **Duc Trong** District, Lam Dong Province

Locator: ca. 11°35'N, 108°25'E

Tiger Conservation Unit No: 120

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Small numbers were reported in Dang Huy Huynh *et al.* (1982).

Site: 64, **Cat Loc**, Cat Tien / Bao Loc Districts, Lam Dong Province

Locator: ca. 11°36'N, 107°17'E

Tiger Conservation Unit No: 120

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. Listed as present by Sugardjito *et al.* (1993), and as still present in the district by Do Tuoc and Le Trong Trai (in prep.).

Site: 65, **Cat Tien**, Tan Phu / Bu Dang / Cat Tien Districts, Dong Nai / Binh Phuoc Provinces

Locator: 11°21'-34'N, 107°11'-28'E

Tiger Conservation Unit No: 120

Protection status: National Park

Level of evidence: provisional

Class of evidence: report etc.

Last positive information: 1992?

Notes. 55 and 15 were estimated in Nam Cat Tien and Tay Bay Cat Tien, respectively, by local people in 1993 and 1991 (Le Vu Khoi 1995, verbally 1998). Indirect evidence was reported in the park in June 1991 and in early 1992 by Eames *et al.* (1992) and Dawson *et al.* (1993) respectively. There are also reports from nearby the Nam Nung and Nam Ca areas (q.v.; Do Tuoc verbally 1998).

Site: 67, **Tan Bien** District, Tay Ninh Province

Locator: ca. 11°30'N, 105°55'E

Tiger Conservation Unit No: 113

Protection status: none traced

Status and conservation of very large mammals in Indochina

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. The district is listed as still possibly supporting the species but no details are given (Do Tuoc and Le Trong Trai in prep.).

Site: 69, **Di Linh** District, Lam Dong Province

Locator: ca. 11°25'N, 108°05'E

Tiger Conservation Unit No: 120

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Small numbers were reported in Dang Huy Huynh *et al.* (1982) and seven were reported to remain to Le Trong Trai (1993).

Site: 71, **Bien Lac-Nui Ong**, Tanh Linh District, Binh Thuan Province

Locator: ca. 11°00'N, 107°03'E

Tiger Conservation Unit No: 120

Protection status: Nature Reserve

Level of evidence: confirmed

Class of evidence: footprints, remains (location?)

Last positive information: 1992

Notes. In 1990 the area was home to 30-35 wild cattle (per Do Tuoc); a 1992 survey collected a skull and saw prints (Do Tuoc verbally 1998); by 1994 only ten wild cattle (not identified to species) remained (Le Trong Trai 1994).

Site: 72, **Duc Linh** District, Binh Thuan Province

Locator: ca. 11°15'N, 107°30'E

Tiger Conservation Unit No: 120

Protection status: unclear

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Local reports indicated a herd of five (Le Trong Trai 1994); it is unclear whether these were within the Ta Kou NR.

Lao

Site: 80, **Phou Dendin**

Locator: 21°40'-22°18'N, 102°00'-40'E

Tiger Conservation Unit No: none

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Respondents in all six villages questioned during 1989-1993 reported the species from their area (Salter 1993a). Gaur were reported by residents of Ban Sop Kang (Berkmüller *et al.* 1995a, Robichaud and Sounthala 1995).

Site: 85, **Nam Kong**

Locator: ca. 21°11'N, 101°25'E

Tiger Conservation Unit No: 80

Protection status: provincial Protected Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported widely throughout the area, including the eastern sector (Phiapalath 1996), arriving in small numbers from the north in the rainy season, but no signs were found (Schaller 1997a).

Site: 86, **Houay Nam Loy**

Locator: ca. 21°00'N, 100°50'E

Tiger Conservation Unit No: none

Protection status: former proposed protected area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Respondents in four of five villages questioned during 1989-1993 reported the species from their area (Salter 1993a).

Site: 88, **Phou Dongwin**

Locator: ca. 20°55'N, 101°40'E

Tiger Conservation Unit No: 80

Protection status: none

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1997

Notes. Villagers report that animals are scarce; tracks of two solitary animals and of a small herd were found (Schaller 1997a).

Site: 89, **Nam Ha** (East and West)

Locator: 20°32'-21°03'N, 100°52'-101°28'E

Tiger Conservation Unit No: 80

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: seen etc.

Last positive information: 1997

Notes. Respondents in seven of 11 villages questioned during 1989-1993 reported the species from their area (Salter 1993a). Reported by all villages investigated in 1996; Phou 2094, the highest mountain in the area, and the Nam Houn area seem particularly important (Phiapalath 1996). In early 1997, most villages reported only intermittent presence, but near Ban Tonglat Gao, 8-10 were reported by villagers, faeces and tracks were abundant and a single bull was seen, as was another

Status and conservation of very large mammals in Indochina

north of Phou 2094. Much fresh evidence was reported at Pong Nam Chat; villagers reported that this was from the same herd. A further herd, of 2-3, was reported in grasslands northeast of Phou 2094. In the adjacent lowlands of the Louang-Namtha plain, tracks of a single were seen in March 1997 along the Nam Oun Noy river (Tizard *et al.* 1997).

Site: 90, **Nam Kan**

Locator: 20°20-46'N, 100°38-54'E

Tiger Conservation Unit No: none

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Berkmüller *et al.* (1995a) listed Gaur on the basis of information from three of eight village interviews.

Site: 92, **Nam Et**

Locator: 20°09-50'N, 103°21-53'E

Tiger Conservation Unit No: none

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: unknown

Notes. Respondents in three of six villages questioned during 1989-1993 reported the species from their area (Salter 1993a). Reported by villagers in February 1993 (Berkmüller *et al.* 1995a). In the area of this, or the Phou Loey NBCA, two people were fined for shooting Gaur in 1992-1993; none was in 1994; further offenses were under investigation in 1995. Gaur were reported by locals to occur in the northeast of the NBCA (WCS 1995a). In 1998, reports were received from two areas, the Phou Thamdin-Phou Hinhe-Houay Te area in the northeast of the NBCA, and Phou Nampha in the southeast. Old tracks were found in the former; the latter was not visited (Davidson in press).

Site: 93, **Phou Loey**

Locator: 19°50'-20°29'N, 103°00-23'E

Tiger Conservation Unit No: none

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1998

Notes. Respondents in 14 of 20 villages questioned during 1989-1993 reported the species from their area (Salter 1993a). In the area of this, or the Nam Et NBCA, two people were fined for shooting Gaur in 1992-1993; none was in 1994; further offenses were under investigation in 1995 (WCS 1995a). In early May 1998, numerous old tracks and dung were found at 1900-2080 m on Phou Loey, with fresh evidence of 1-4 animals being found in mid-May; village reports came from several other areas and all suggested a steep decline in numbers. Poaching offenses were again reported to have occurred (Davidson in press).

Site: 94, **Nam Xam**

Locator: 20°02-14'N, 104°18-53'E

Tiger Conservation Unit No: 95

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1998

Notes. Respondents in four of 11 villages questioned during 1989-1993 reported the species from their area (Salter 1993a). Locals estimated in 1998 that animals, totalling 30-40, were widespread in

the NBCA, using 4-5 important saltlicks; tracks were found at Pong King (1-2 animals) and around a lick near the Houay Pong (Showler *et al.* 1998b).

Site: 99, **Hongsa** special zone
Locator: ca. 19°45'N, 101°45'E
Tiger Conservation Unit No: 81
Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Villagers from several localities reported Gaur as present, with recent (1994) claims from Lake Nam Sang and at Nam Sip (Bergmans 1995).

Site: 97, **Northern Xiangkhouang**

Locator: ca. 19°50'N, 103°20'E
Tiger Conservation Unit No: none

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Villagers reported that Gaur were now very rare in the Muong Kham-Pian Kang area, but reported that about 20 animals visited a saltlick west of Ban Nyawt Liang (Schaller and Robichaud 1996). The Provincial Agriculture and Forest Office reports about 10 animals (K. Khounboline verbally 1998).

Site: 102, **Southern Xiangkhouang**

Locator: ca. 19°00'N, 103°40'E
Tiger Conservation Unit No: none

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Ambiguous reports were received from villagers in the Phouviang area; some asserted that the species was locally extinct, others opined that a few remained (Schaller and Robichaud 1996). The Provincial Agriculture and Forest Office reports presence (K. Khounboline verbally 1998).

Site: 103, **Nam Chouan**

Locator: 18°45'-19°16'N, 103°58'-104°47'E
Tiger Conservation Unit No: 99

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. In January 1998 residents of a village on the margin of the area reported many to be present in at least some parts of the NBCA (W. G. Robichaud verbally 1998).

Site: 104, **Bolikhan** District, Bolikhamxai Province

Locator: ca. 18°45'N, 103°45'E
Tiger Conservation Unit No: 98

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Province authorities report wild cattle (date of report not ascertained) which on grounds of

Status and conservation of very large mammals in Indochina

habitat seem likely to be this species (S. Sawathvong verbally 1998). Site probably abuts southern Xiangkhouang (q.v.).

Site: 105, **Vienthong** District, Bolikhamxai Province

Locator: 18°30'N, 104°45'E

Tiger Conservation Unit No: 99

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Dates of sightings were not established but the interpreter took considerable care to clarify that two types of wild cattle were being reported in January 1998 in the lower-lying area east of Phou Kadeung (W. G. Robichaud verbally 1998).

Site: 106, **Nam Phoun** (= Pou) District

Locator: 18°12-47'N, 101°04-29'E

Tiger Conservation Unit No: 81

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints, dung etc.

Last positive information: 1997

Notes. Respondents in 13 of 16 villages questioned during 1989-1993 reported the species from their area (Salter 1993a). Evidence in March-June 1997 was scarce in north and south, mainly around mineral licks, but signs were frequent in the centre. Tracks of young were found. Poaching is a threat. A crude population estimate of 200-300 animals was based upon fresh signs (Boonratana 1997). In early 1998 hunting of the species was reported from the north, central and southern parts of the reserve, leg bones were found close to Pong Kok (although cause of death was not ascertained) and it was felt that the animals may become confined to the central and southwest of the reserves as a result of human activities; three villages from Ban Dan were penalised by the District Agriculture and Forestry Office as a result of poaching (Boonratana 1998b, R. Boonratana *in litt.* 1998).

Site: 107, **Pa Sak Xaignabouli** District

Locator: ca. 18°30'N, 101°45'E

Tiger Conservation Unit No: none

Protection status: former proposed protected area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Respondents in eight of nine villages questioned during 1989-1993 reported the species from their area (Salter 1993a).

Site: 109, **Phou Khaokhoay** District

Locator: 18°14-34'N, 102°44'-103°29'E

Tiger Conservation Unit No: 98

Protection status: National Biodiversity Conservation Area

Level of evidence: extinct?

Class of evidence: report, footprints

Last positive information: unknown

Notes. Reported by Phiathop (1989, in Phanthavong and Santiapillai 1991) and by villagers in Salter and Phanthavong (1990) and by respondents in 12 of 16 villages questioned during 1989-1993 (Salter 1993a), but no evidence was found of the persistence of any wild cattle during 1996-1997 (J. Parr verbally 1998). A cow trail seen near the Nam Leuk dam-site in October 1994 (Payne *et al.* 1995) was claimed as wild, but no basis for ruling out a domestic animal is given. A guide's report of a sighting of four Gaur in May 1994 in the Nam Hi region (Payne *et al.* 1995) is the most recent

plausible evidence of the species, which clearly occurred into the early 1980s in reasonable numbers (J. Parr verbally 1998, from local reports).

Site: 110, Sangthong

Locator: ca. 18°20'N, 102°10'E

Tiger Conservation Unit No: none

Protection status: none

Level of evidence: provisional

Class of evidence: footprints, report

Last positive information: 1996?

Notes. Signs claimed in 1996 by villagers to be those of wild cattle were seen in the north of the district around Ban Wangma and Ban Taohai and villagers reported the animals' regular presence in the northern half of the district. Villagers were confused and inconsistent in their descriptions of the two named forms of wild cattle that they claimed to inhabit the area (as elaborated in Duckworth 1996b), but on balance Gaur fitted best their descriptions. Occurrence was reportedly seasonal and indeed no fresh signs were found during the survey (February-March); visits apparently occurred in the wet season (Duckworth 1996a). Foppes (1995) received reports that there were 40-50 Gaur in the area.

Site: 112, Nam Kading

Locator: 18°11-39'N, 103°54'-104°44'E

Tiger Conservation Unit No: 99

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints, remains in field

Last positive information: 1995

Notes. Respondents in one of two villages questioned during 1989-1993 reported the species from their area (Salter 1993a). Signs were found on the high ridges of the NBCA during December 1994-May 1995; Banteng was not ruled out from some (but is unlikely in this habitat). An old skull in the lower reaches of the Houay Basong (not collected) had probably floated there in the previous rainy season. A hunter reported a herd of four near the abandoned village of Ban Donme. Villagers reported that the species was now found in more remote areas such as the headwaters of the Nam Tuk (WCS 1995b; R. J. Timmins *in litt.* 1998). Over 30 years previously Gaur were frequent visitors to saltlicks in the area between the NBCA and Ban Phonsi, but visit levels were already dropping as a result of rampant hunting (Brix and Deuve 1963); the area is now very disturbed.

Site: 114, Nam Theun Extension

Locator: 18°21-48'N, 104°45'-105°12'E

Tiger Conservation Unit No: 99

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Schaller (1995) received reports from the upper Nam Chat and upper Nam Gnouang, but no villagers interviewed in other parts of the area in 1997 claimed the species to be present (Tobias 1997).

Site: 115, Nakai-Nam Theun

Locator: 17°36'-18°23'N, 105°02'-46'E

Tiger Conservation Unit No: 99

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: seen etc.

Last positive information: 1997

Status and conservation of very large mammals in Indochina

Notes. Respondents in 32 of 42 villages (some on the Nakai Plateau) questioned during 1989-1993 reported the species from their area (Salter 1993a). A 1994 broad estimate of "up to 200" for the NBCA (Timmins and Evans 1996) includes an unknown proportion on the Nakai plateau. Signs were found in most areas visited, but most were of singles rather than the herds characteristic of healthy populations. Specific records from 1994 are: numerous prints were found in the upper Houay Morrow valley, as well as a skull from which the horns had been cut; signs were seen in seven locations in the nearby Nam Mon (Xot) valley, where a saltlick exists; signs were seen twice along the Nam Xot above Tasaeng Navang and thrice on ridges between the Xot and upper Kata catchments; a few footprints (and remains) were found near a tributary of Houay Satun around 1100 m; saltlicks near the Nam Katong / Nam Zi confluence in the northern mountains may also be important; signs were found along the Navang logging road, on the Phou Song ridge east of Ban Navang and on parts of Phou Laoko, including its summit ridge (2100 m); Gaur were reported by villagers from the complex of villages within the protected area (Ban Tong, Ban Pong and Ban Nameuy) and one had reportedly been shot near Ban Buk just prior to the surveyors' arrival (Timmins and Evans 1996; R. J. Timmins *in litt.* 1998). In 1996 one was seen on the Navang logging road (Duckworth in press). Records from February-May 1997 are: fresh tracks, Navang logging road (950 m); several sets of old tracks, upper Nam Mon in small grasslands (900 m); tracks and dung around the upper Nam Xot (1500 m); one set of tracks, Nam Phao (800 m). The population is clearly much depleted by hunting (Tobias 1997); villagers reported in 1994 that Vietnamese poachers had recently caused a crash in the population (R. J. Timmins *in litt.* 1998).

Site: 116, Nakai Plateau

Locator: 17°36'-18°00'N, 104°52'-105°32'E

Tiger Conservation Unit No: 99

Protection status: part National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: seen etc.

Last positive information: 1997

Notes. Gaur were reported to be present, perhaps numerous (Sayer 1983b) and the area was especially known for Gaur in historical times (Phanthavong and Santiapillai 1991). Respondents in 32 of 42 villages (some elsewhere in the Nakai-Nam Theun NBCA) questioned during 1989-1993 reported the species from their area (Salter 1993a). In 1994, tracks were found along the Nam Xot and Nam On and a male was seen south of the Houay Thong in broad daylight (WCS 1995; Timmins and Evans 1996; R. J. Timmins verbally 1994). Footprints believed to be of Gaur were found near Ban Namxot in March 1995 (P. Chardonnet verbally 1995; WCS 1995c). In 1996, recent tracks of probably a single were found in the Phek Phalam area, while water sources there and to the west had numerous signs; the number of individuals involved and the time period of use was unclear (R. J. Timmins *in litt.* 1998). Several sets of tracks were found (detailed sites are not given) in 1997; villagers estimated 40-50 animals remained (Tobias 1997).

Site: 117, Nam Theun Corridor

Locator: 17°46'-18°10'N, 104°48'-105°06'E

Tiger Conservation Unit No: 99

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: footprints

Last positive information: 1995?

Notes. Footprints of wild cattle were seen southwest of Keng Luang in late January 1995 (WCS 1995b); although the shape seemed odd, they were believed by the guide to be this species (R. J. Timmins *in litt.* 1998). Reports in Timmins and Evans (1996) from "45 km downstream of the [Nam Theun 2] damsite" refer also to this area. See also Khammouan Limestone NBCA.

Site: 118, Khammouan Limestone

Locator: 17°26'-18°05'N, 104°25'-105°10'E

Tiger Conservation Unit No: 99

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: footprints

Last positive information: 1996

Notes. Respondents in only one of 14 villages questioned during 1989-1993 reported the species from their area (Salter 1993a); however, this appears to underestimate considerably the importance of the area for the species. Reported from the northern forest fringe of the NBCA; common reports of wild cattle from Phou Hai are presumed to relate at least primarily to this species (Timmins and Evans 1996). Recent faeces and recent and old footprints were found southwest of Khuadin, and old prints were found around waterholes in the north of the Central Forest Area, all in 1996. Prints were at very high density, but it was not possible to tell how many animals were involved, or the species. Prints were also found on Phou Onghon and animals reportedly range on the Phou Hai Plateau; this is probably the same population as that seen in the Nam Theun Corridor proposed NBCA (q.v.). These areas, and the Houay Namahung by which animals can enter the Central Forest Area, are outside the current boundaries but need urgently to be protected as habitat links between this NBCA, the Nakai Plateau and the Nam Kading NBCA (Timmins 1997). The species was reported as persisting at four and extinct at four of 12 villages in early 1998; specific reported location were Phou Mon, to the north of the NBCA and within the NBCA in Kouan Song Hong, Phou Ak summit; animals were reported to be absent from areas of rugged karst (Steinmetz 1998b).

Site: 119, **Hin Namno**

Locator: 17°15'-40'N, 105°43'-106°09'E

Tiger Conservation Unit No: 99

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints etc.

Last positive information: 1998

Notes. Residents of several villages reported wild cattle, probably Gaur, within the NBCA. The most convincing reports came from Ban Tasang and Ban Vangngnow who reported a few encounters within 1993-1996 in the least accessible, more extensively forest areas with water supplies (Timmins and Khounboline 1996). Field survey in 1998 found none within the NBCA, but abundant signs (fresh footprints and deeply eroded access trails) were found at a saltlick 15 km west of the border; there were also many reports that the species persisted on Phou Louang (Walston in prep.).

Site: 120, **Xe Bangfai**

Locator: ca. 17°00'N, 106°20'E

Tiger Conservation Unit No: 99

Protection status: former proposed protected area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reports were received in 1998 of the species's presence but no signs were found on a brief reconnaissance (J. Walston and K. Khounboline verbally 1998).

Site: 121, **Phou Xang He**

Locator: 16°42'-17°04'N, 105°19'-106°06'E

Tiger Conservation Unit No: 99

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: seen etc.

Last positive information: 1993

Notes. Respondents in 13 of 18 villages questioned during 1989-1993 reported the species from their area (Salter 1993a). Footprints, mainly old, were found in open grassy glades on Phou Xang He, and

Status and conservation of very large mammals in Indochina

one animal was seen, in March-April 1993 (Duckworth *et al.* 1994). A set of horns was in Ban Nahang Noy in early 1998; bovine signs found in the field were not identified to species (Boonratana 1998).

Site: 122, **Dong Phou Vieng**, Savannakhet Province

Locator: ca. 16°26'N, 106°58'E

Tiger Conservation Unit No: none

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints etc.

Last positive information: 1997

Notes. In April-June 1997, Gaur were reported to be largely extirpated from the NBCA. Signs, both of herds and individuals, were found extensively in the Phou Lapeung sector suggesting that it supported a large population, estimated on the basis of distribution of signs of similar age to comprise three or more herds totalling at least 50. Gaur were also reported from the Dong Lai area in the north of the extension (Steinmetz 1998a).

Site: 123, **Xe Sap**

Locator: 15°56'-16°19'N, 106°41'-107°28'E

Tiger Conservation Unit No: 106 / 107

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. A small group was reported by the district to Bergmans (1995) to be seen several times per year in the Muong Kaleum area; one specimen was accidentally killed in about 1988. Reported in 1995 from forest west of the Xe Kong north of Kaleum (Schaller 1995) and to be scarce in the northern part of the area, but respondents did not seem very familiar with the species (Schaller and Bounsou 1996). In 1997, one Gaur was reported to remain in tall grassland close to Ah Ror; villagers at Ban Angouas said that they were very rare, and were hunted by Vietnamese; villagers in Ban Proy and Ban Aluk reported them from sacred forest on Phou Leung (Showler *et al.* 1998a). Also in 1997, Gaur were reported to be abundant in the centre and north of the area, and to occur in the Kaleum area (south of the NBCA) and Thong Kah area, with migration occurring between these two areas (R. Steinmetz *in litt.* 1998).

Site: 126, **Xe Bang-Nouan**

Locator: 15°44'-16°01'N, 105°53'-106°18'E

Tiger Conservation Unit No: 104

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: footprints, report

Last positive information: 1997

Notes. Reported from 13 of 18 villages around the NBCA in 1989-1993 (Salter *et al.* 1990, Salter 1993a). Many signs were found in May-July 1995 in expanses of grass and scrub at the west of the Central hills, but the majority were old, perhaps from the previous wet season. Villagers' reports also stressed the importance of the Central Hills (Timmins and Bleisch 1995). Villagers recently reported Gaur from the south-central part of the reserve, 4 km from Ban Khanteuy, and stated that their arrival in 1997 coincided with that of elephants and that they move with them on a day-to-day basis. Great care is needed in identifying signs in this area as domestic cattle are allowed to free-range in the reserve; these animals are checked only sporadically by the villagers (R. Dechaineux verbally 1998).

Site: 127, **Phou Xiang Thong**

Locator: 15°19'-56'N, 105°25'-47'E

Tiger Conservation Unit No: 122

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: footprints, report

Last positive information: 1996?

Notes. Reported from five of eight villages around the NBCA in 1989-1993 (Salter *et al.* 1990, Salter 1993a) and reported by villagers in April 1992 (Berkmüller *et al.* 1995a), but no signs were found by Boonratana (1998a). Evans *et al.* (1996a) found possible footprints in the bed of the Houay Vangmoun in early 1996.

Site: 129, South of the Xe Don

Locator: ca. 15°35'N, 106°20'E

Tiger Conservation Unit No: 109

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported from some villages in 1988-1990 (Salter *et al.* 1990).

Site: 130, Phou Theung

Locator: 15°25-54'N, 106°29-51'E

Tiger Conservation Unit No: none

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Village reports, presumably from a February 1994 visit to seven villages (Berkmüller *et al.* 1995a).

Site: 131, Tha Teng

Locator: 15°25'N, 106°20'E

Tiger Conservation Unit No: 108

Protection status: former proposed protected area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Respondents in two of three villages questioned during 1989-1993 reported the species from their area (Salter 1993a).

Site: 132, Dakchung Plateau

Locator: ca. 15°20'N, 107°10'E

Tiger Conservation Unit No: 110

Protection status: part former proposed protected area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Respondents in the only village questioned in this area (as the Xe Kong pine forest proposed protected area) during 1989-1993 reported the species from their area (Salter 1993a). Local reports in 1997 suggested that Gaur was almost extinct in the district; one was shot in 1992 (Showler *et al.* 1998a).

Site: 133, Phou Ilang

Locator: ca. 15°00'N, 105°40'E

Tiger Conservation Unit No: 122

Protection status: former proposed protected area

Status and conservation of very large mammals in Indochina

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported from many villages in 1988-1990 in and south of the hill (Salter *et al.* 1990). No trophies were found in Ban Nonpachao and villagers reported in 1991 that the species was locally extinct (Cox *et al.* 1992a).

Site: 134, **Bolaven Northeast** (= Phou Kateup)

Locator: 15°00'-24'N, 106°23'-49'E

Tiger Conservation Unit No: 108

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported from villages around the area in 1988-1990 (Salter *et al.* 1990). Village reports (Berkmüller *et al.* 1995a), but not found in the southern parts of this area by WCS (1995d).

Site: 135, **Bolaven Southwest** (= Phou Luang)

Locator: 14°42'-15°06'N, 106°21'-39'E

Tiger Conservation Unit No: 113

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported from many villages around the area in 1988-1990 (Salter *et al.* 1990). Villagers in 1995 reported a group of about 10 west of Ban Don Kong; a few other scattered reports lacked details and seemed to refer to smaller numbers, in general suggesting a sparse population restricted to the remotest areas (WCS 1995d).

Site: 136, **Xe Khampho**

Locator: 14°35'-15°00'N, 106°11'-35'E

Tiger Conservation Unit No: 113

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints, report

Last positive information: 1997?

Notes. Reported from many villages in and around the area in 1988-1990 (Salter *et al.* 1990). Footprints were found in April / May 1991 in the unprotected part of the Xe Kong plains east of the Xe Kong river (Cox *et al.* 1992a). Reported from the north of the area in 1993 (Duckworth *et al.* 1994). Recorded during some of 19 village interviews (Berkmüller *et al.* 1995a). Footprints were found in January 1997 at Nong Kaa (Davenport *et al.* 1997) and animals were reported in December 1997 to be widespread in the area, east to the Xe Pian NBCA and south to the Cambodian border (W. G. Robichaud verbally 1998).

Site: 137, **Phou Kathong**

Locator: 14°54'-15°19'N, 106°47'-107°14'E

Tiger Conservation Unit No: none

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported from some villages around the area in 1988-1990 (Salter *et al.* 1990) and claimed by villagers in 1997 to occur, particularly around Ban Hin Dam and Ban Done Khene-Nyai, but no signs could be found (Davidson *et al.* 1997).

Site: 138, **Dong Ampham**

Locator: 14°38'-15°18'N, 107°08-39'E

Tiger Conservation Unit No: 113

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints, dung etc.

Last positive information: 1997

Notes. Reported from both villages investigated around the NBCA in 1989-1993 (Salter *et al.* 1990, Salter 1993a). In January and April-May 1997, tracks, faeces and flattened vegetation were found north of Ban Keng Maw (Xe Xou lowlands) in an area of dense thickets, bamboo, open semi-evergreen forest and grassland. Evidence of a group (perhaps the same?) was found along the Nam Baham and tracks of apparently solitary individuals were found elsewhere in the zone. Villagers claimed they did not hunt Gaur (killing one would invoke evil spirits and bad fortune on the family) but the species's status suggests that this tradition is widely flouted, or outsiders hunt the area (Davidson *et al.* 1997).

Site: 139, **Nam Ghong**

Locator: ca. 14°30'N, 107°00'E

Tiger Conservation Unit No: 113

Protection status: Provincial Protected Area; former proposed protected area

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1998

Notes. Reported from the area, but only in small numbers (Schaller 1997b, W. G. Robichaud verbally 1998). Tracks were found in several areas in early 1998; mostly from the previous wet season but with fresh tracks towards the Vietnamese border (Fernando in prep.; R. J. Tizard *in litt.* 1998).

Site: 140, **Dong Hua Sao**

Locator: 14°50'-15°11'N, 105°55'-106°18'E

Tiger Conservation Unit No: 113

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints etc.

Last positive information: 1997

Notes. Reported from eight of 11 villages in and around the NBCA, and many to the south and west of the NBCA in 1989-1993 (Salter *et al.* 1990, Salter 1993a). Footprints of a single animal were found atop Phou Phongkham / Phou Nalong in mid 1993 and the animals were reported to be commonest around the upper Houay Touay Gnai (Duckworth *et al.* 1994). In the lowlands in 1996, old footprints of wild cattle from the previous wet season were found at four locations around the Houay Bong and the Houay Bangliang; [a provisional record from Nong Houdin has since been retracted; T. D. Evans *in litt.* 1998]; footprint shape and village reports both suggested Gaur rather than Banteng (Evans *et al.* 1996b). Fresh tracks were found at all three sites visited in late 1997: two lowland (Houay Namphak and Houay Touay Gnai), both with signs of young, and one on the plateau (Phou Phongkham area). Pong Ban Thong and Nong Khimin both showed signs of small herds (Boonratana 1998a).

Site: 141, **Xe Pian**

Locator: 13°55'-14°47'N, 105°54'-106°29'E

Tiger Conservation Unit No: 113

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: seen etc.

Last positive information: 1997

Status and conservation of very large mammals in Indochina

Notes. Reported from all 11 villages in and around the NBCA, and many to the north of it, in 1989-1993 (Salter *et al.* 1990, Salter 1993a). Footprints were found rarely in Dong Kalo in May / June 1992 (Cox *et al.* 1992a). Guides reported a herd of four from the Houay Kua saltlicks in December 1992; footprints were found commonly there, and scattered elsewhere in the Main Block, in November 1992-February 1993 (Duckworth *et al.* 1994). Villagers in 1997 reported that animals moved between Dong Kalo and Cambodia and that poaching was rare, as a result of traditional beliefs. Signs, often recent, and of small herds as well as singles, were found almost throughout the surveyed areas. Considerable details is given on habitat use and the possibilities of local movements; in summary, there seem to be separate populations centred on the Main Block and Dong Kalo (WWF / Burapha 1997). A small group was seen in the Main Block in mid 1997 (R. Steinmetz *in litt.* 1997).

Site: 142, **Dong Khanthung**

Locator: 14°07'-32'N, 105°12'-45'E

Tiger Conservation Unit No: 122

Protection status: proposed National Biodiversity Conservation Area; currently Protection Forest in some areas, provincial Conservation Forest in others, and unprotected elsewhere.

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1997

Notes. Reported from a few villages in 1988-1990 (Salter *et al.* 1990). Reported in 1996 as still present in four out of seven villages, and recently extinct in a further two. Villagers believed Gaur to occur in similar areas to Banteng, but to be less numerous (Berkmüller and Vilawong 1996). Tracks reported by villagers in Ban Khem (ICF 1996). Records in 1997: many 2-3 month old tracks west of Ban Khem were perhaps all from one small (<5) herd. Some more recent tracks were found near the Xe Lampao and just northwest of there around the abandoned village of Ban Taseun on 28-29 March (Wolstencroft in prep.). Tracks, all old, were seen at five localities in the south of the area in early 1998; villagers from Bans Houayxai, Kadian and Kadan all indicated that Gaur did not occur in their areas (Round and Vongkhamheng 1998).

Site: 143, **far southern Champasak**

Locator: 13°55'-14°05'N, 105°55'-106°10'E

Tiger Conservation Unit No: 113

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported from a few villages in 1988-1990 (Salter *et al.* 1990).

Cambodia

Site: 150, **Virachey**

Locator: ca. 14°30'N, 107°10'E

Tiger Conservation Unit No: 113

Protection status: National Park

Level of evidence: confirmed

Class of evidence: seen etc.

Last positive information: 1998

Notes. "Commonly" hunted in the park (Robinson and Yem Sokhan 1996). Further reports of hunting were gathered in 1996 by Desai and Lic Vuthy (1996). Occurs in Phnom Veal Thom (in the core zone, north of Sesan river) (A. Maxwell *in litt.* 1998). A French team reportedly killed an animal in the park in July 1997 (from a herd of 10), and a further case of poaching, of two animals, occurred in late 1997 (G. Patterson per E. Wikramanayake verbally 1998). In late February 1998, tracks were seen in several parts of the upper O'Lalay river; a single and a group of four were observed in the savannah at the headwaters of the Siem Pang, where tracks were abundant. The horns of an adult bull recently killed in the latter area were seen; animals were reportedly always seen there on hunting expeditions. The meat of the shot animal was dried. In general the area west of the O'Lalay was reported to hold more Gaur (Weiler 1998a). The park may have the most robust Gaur population in Cambodia (Heng Kimchhay *et al.* 1998).

Site: 152, **Phnom Voene**, Ratanakiri Province

Locator: ca. 14°00'N, 106°45'E

Tiger Conservation Unit No: 113

Protection status: none

Level of evidence: provisional

Class of evidence: footprints

Last positive information: 1998

Notes. Footprints seen in several meadows in early 1998 (Weiler 1998b).

Site: 153, **O'Chum** District, Ratanakiri

Locator: ca. 14°00'N, 107°15'E

Tiger Conservation Unit No: 113

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reportedly occurs in the O'To Teung forest (Bann 1997), but the interview results summarised in Heng Kimchhay *et al.* (1998) indicate that this area is unlikely to support many if any wild cattle.

Site: 154, **Bor Keo** District, Ratanakiri Province

Locator: ca. 13°50'N, 106°50'E

Tiger Conservation Unit No: 113

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Listed in table of hunted species from 1997 villager reports (Emerson 1997). Based on the interview results summarised in Heng Kimchhay *et al.* (1998), it seems unlikely that this area supports large numbers of the species.

Site: 156, **North and west of Ban Lung**, Ratanakiri Province

Locator: 13°39'-54'N, 106°43'-51'E

Tiger Conservation Unit No: 113

Status and conservation of very large mammals in Indochina

Protection status: none

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1996

Notes. One fresh and 13 old trails (only two of singles, the others from groups) were found along the 99 km walked in May-June 1996, indicating a very low population (Desai and Lic Vuthy 1996). Based on the interviews summarised in Heng Kimchhay *et al.* (1998), it seems unlikely that this area still supports the species regularly.

Site: 159, **Phnom Kulen**

Locator: ca. 13°40'N, 104°00'E

Tiger Conservation Unit No: 122

Protection status: National Park

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported in February 1993 during interviews with local people (Salter 1993b).

Site: 161, **Lomphat**

Locator: ca. 13°20'N, 107°10'E

Tiger Conservation Unit No: 113

Protection status: Wildlife Sanctuary

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported by Henning (1994); local reports that concentrations still occurred in 1996 were received by Desai and Lic Vuthy (1996). The area south of the Srepok is still reported to contain medium Gaur densities, but the part to the north apparently supports very few very large mammals (Heng Kimchhay *et al.* 1998). In an extensive survey of the area north of the Srepok in mid 1998, the only evidence of the species was one set of old prints provisionally identified as Gaur (Timmins in prep.).

Site: 162, **Roniem Daun Sam**

Locator: ca. 13°20'N, 102°10'E

Tiger Conservation Unit No: 124

Protection status: Wildlife Sanctuary

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Hunters' reports from the sanctuary and the surrounding general area were gathered in 1998 (Heng Kimchhay *et al.* 1998).

Site: 164, **Northeast Mondulkiri Province**

Locator: ca. 13°00'N, 107°25'E

Tiger Conservation Unit No: 113

Protection status: none

Level of evidence: confirmed

Class of evidence: footprints, remains in field etc.

Last positive information: 1995

Notes. 68 sets of footprints were found in 155 km of survey between Senmonorom and the Srepok river in June 1995 (Sun Hean 1995a). A small area of Mondulkiri with numerous fresh wild cattle footprints, dung and grazing signs in March-April 1994 was estimated to hold 10-15 Gaur; it appears some were observed directly. There were also many signs from the former wet season, demonstrating year-round presence (see Yok Don NP). An unspecified number of wild cattle carcasses were found

which had had parts of their skulls removed (Dioli 1994). The area is believed to be to the west and south of the Srepok from the Vietnamese border. To the north of the Srepok recent reports of good numbers were gathered in 1998 (Heng Kimchhay *et al.* 1998).

Site: 165, **East Mondulkiri Province**

Locator: 12°33-55'N, 107°21-32'E

Tiger Conservation Unit No: 113

Protection status: none

Level of evidence: confirmed

Class of evidence: seen, footprints

Last positive information: 1996

Notes. The species was widely recorded over the northern part of 223 km walked in April-May 1996, but unrecorded in the southern part, where human disturbance was higher (Desai and Lic Vuthy 1996). A herd of four had earlier been seen from the air, just northwest of this area, in March 1994 (Olivier and Woodford 1994).

Site: 166, **Phnom Prich**

Locator: ca. 12°30'N, 107°10'E

Tiger Conservation Unit No: 113

Protection status: Wildlife Sanctuary

Level of evidence: provisional

Class of evidence: report

Last positive information: 1994

Notes. Hunters' reports suggested that this part of Mondulkiri Province had the greatest numbers of large mammals (Heng Kimchhay *et al.* 1998).

Site: 168, **Phnom Nam Lyr**

Locator: ca. 12°20'N, 107°50'E

Tiger Conservation Unit No: 113

Protection status: Wildlife Sanctuary

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Occurs (Desai and Lic Vuthy 1996), but less common than in the Phnom Yangke / Yang Por areas (Lic Vuthy *in litt.* 1998). Hunters' reports suggested that some numbers remain (Heng Kimchhay *et al.* 1998).

Site: 169, **Snoul**

Locator: ca. 11°50'N, 107°00'E

Tiger Conservation Unit No: 113

Protection status: Wildlife Sanctuary

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Frequently seen by villagers according to 1996 reports (Nhiel Thorn and Be Seng Leang 1996). The small sector in Keo Sema District (Mondulkiri) and land outside the sanctuary to the east and north was reported to be much richer than the majority of the sanctuary, in Kratie Province (Heng Kimchhay *et al.* 1998).

Site: 170, **Phnom Aural**

Locator: ca. 11°40'N, 104°05'E

Tiger Conservation Unit No: 125

Protection status: Wildlife Sanctuary

Level of evidence: provisional

Status and conservation of very large mammals in Indochina

Class of evidence: report

Last positive information: unknown

Notes. Reports by local people and / or soldiers need checking (Chay Samith verbally 1998). Interviews summarised in Heng Kimchhay *et al.* (1998), suggest that the area may retain in large numbers.

Site: 172, **Kirirom**

Locator: ca. 11°05'N, 104°00'E

Tiger Conservation Unit No: 125

Protection status: National Park

Level of evidence: provisional

Class of evidence: report, footprints

Last positive information: 1995?

Notes. Numbers between 20 and 50 according to local soldiers in 1995 (Lay Khim and Taylor-Hunt 1995). Wild cattle (species unknown) prints were observed at a water-hole in 1995 (D. Ashwell verbally 1998) and more were seen in January 1998 (F. Goes *in litt.* 1998).

Site: 173, **Phnom Bokor**

Locator: ca. 10°30'N, 104°00'E

Tiger Conservation Unit No: 125

Protection status: National Park

Level of evidence: provisional

Class of evidence: footprints?, report

Last positive information: unknown

Notes. Two killings by soldiers for food from the north of the area were reported in 1997 and animals also apparently occur in small numbers in the southern third; there is doubt as to the specific identification as at least one informant stated that the animal was red in pelage (K. W. Sorensen verbally 1998). Footprints (unidentified) were found in February 1998 (F. Goes *in litt.* 1998).

Site: 174, **Ream** (Preah Sihanouk)

Locator: ca. 10°20'N, 103°30'E

Tiger Conservation Unit No: 125

Protection status: National Park

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Wild cattle (species unknown) occur infrequently in the southern third of the park, and more frequently so in the north (P. Im verbally 1998).

Yunnan Province, China

Site: 183, **Tongbianguan**, Yingjiang County

Locator: ca. 24°30'N, 97°30'E

Tiger Conservation Unit No: not applicable

Protection status: not known

Level of evidence: extinct?

Class of evidence: not applicable

Last positive information: 1979

Notes. The last record was in 1979 (Wang Yingxiang verbally 1998).

Site: 185, **Wei Yuan Jiang**, Jing Gu County

Locator: 23°30'N, 100°50'E

Tiger Conservation Unit No: not applicable

Protection status: Provincial Nature Reserve

Level of evidence: provisional

Class of evidence: not applicable

Last positive information: unknown

Notes. Reported by local foresters in 1995 (Wang Weimin verbally 1998).

Site: 186, **Nanguanhe**, Cangyuan County

Locator: ca. 23°20'N, 90°00'E

Tiger Conservation Unit No: not applicable

Protection status: National Nature Reserve

Level of evidence: confirmed

Class of evidence: not applicable

Last positive information: unknown

Notes. The 1997 population probably was lower than 20 and stable or slightly increasing, based upon local foresters' estimates (Wang Yingxiang verbally 1998, Jiang Wang Gao verbally 1998); the 30-50 listed for "Cang Yucor" by Byers *et al.* (1995) are presumed to refer to this area.

Site: 188, **Ximeng** Country

Locator: ca. 22°50'N, 99°30'E

Tiger Conservation Unit No: not applicable

Protection status: unknown

Level of evidence: extinct?

Class of evidence: not applicable

Last positive information: pre-1980

Notes. The area supported Gaur until the 1980s (Wang Yingxiang verbally 1998).

Site: 189, **Simao** Country

Locator: 22°20'-55'N, 100°30'-101°30'E

Tiger Conservation Unit No: not applicable

Protection status: partly Provincial Nature Reserve (1997 on)

Level of evidence: confirmed

Class of evidence: not applicable

Last positive information: unknown

Notes. A total of 50-80 given by Ma Yiqing and Wang Yingxiang (1995) is substantially greater than the 14 listed for 1985 by Yang Dehua and Zhang Cunjie (1987). Gaur are still present in at least the Zulin area (q.v., Banteng) (Wang Yingxiang verbally 1998) and the Cai Yang He Provincial Nature Reserve, ca. 22°45'N, 101°25'E (Wang Weimin verbally 1998).

Site: 191, **Lancang** County

Locator: ca. 22°30'N, 100°00'E

Tiger Conservation Unit No: not applicable

Status and conservation of very large mammals in Indochina

Protection status:

Level of evidence: extinct?

Class of evidence: not applicable

Last positive information: pre-1980

Notes. The area formerly supported Gaur but by the 1980s none was left (Wang Yingxiang verbally 1998).

Site: 193, **Xishuangbanna**

Locator: 21°09'22°36'N, 99°58'-101°50'E

Tiger Conservation Unit No: not applicable

Protection status: National Nature Reserve

Level of evidence: confirmed

Class of evidence: not applicable

Last positive information: 1997

Notes. Most Gaur of Yunnan now occur in the Xishuangbanna Prefecture, largely in the National Nature Reserve all five parcels hold Gaur (Wang Yingxiang verbally 1998). Mengyang probably holds at least 100, and in parts of the east footprints are "nearly everywhere". Footprints were found in Mangao in March 1997 and the area is believed to support two groups totalling 7-8 animals. In Shangyong 30-40 head were estimated in 1997. There is no recent firm information from Menglum and Mengla (Jiang Wang Gao verbally 1998). W. V. Bleisch (*in litt.* 1998) found footprints probably of this species in remote parts of Mengyang in 1997.

The total of 518 listed for the prefecture as a whole in 1985 by Yang Dehua and Zhang Cunjie (1987) is of unknown accuracy (Wang Yingxiang, Jiang Wang Gao verbally 1998). The total of 600 listed for Xishuangbanna by Byers *et al.* (1995) was largely based on villagers' information collected by local foresters and is believed to be a considerable overestimate due to duplicate reporting of groups of Gaur by different villages; survey in 1997 suggested no more than 300, when populations were assessed (by signs) in areas of known villagers' estimates (Jiang Wang Gao verbally 1998).

Locals in Mengyang claimed in 1997 that in the 1950s there were 4-5 groups, each of 20-30 animals; in the 1970s there were still 4-5 groups, but each contained only 5-10; and in the 1990s, they hardly find Gaur at all (Wu Zhaolu 1997, verbally 1998). However, caution must be taken in interpreting this as a population collapse as human settlement patterns changed greatly in this period (Wu Zhaolu and Peng Mingchun 1997). Local foresters claim that numbers in the nature reserve have increased since the mid 1980s (Wang Yingxiang verbally 1998, Jiang Wang Gao verbally 1998).

Annex 4: Banteng records from Indochina

Sites are shown on Fig. 4, numbered as in the text.

Vietnam

Site: 7, **Muong Nhe**, Muong Te / Muong Lay Districts, Lai Chau Province

Locator: 22°00-26'N, 102°10-45'E

Tiger Conservation Unit No: none

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. Listed as "status uncertain" as a result of records in 1974 and 1991; no further details (Cox *et al.* 1992b).

Site: 37, **Ba Na-Nui Chua**, Hoa Vang District, Da Nang Municipality

Locator: ca. 15°55'N, 108°00'E

Tiger Conservation Unit No: perhaps 110 or 111

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reports from locals were received by Do Tuoc and Le Trong Trai (in prep.), but they stressed that they need confirmation.

Site: 42, **Sa Thay** District, Kon Tum Province

Locator: ca. 14°25'N, 107°47'E

Tiger Conservation Unit No: 113

Protection status: includes one Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Recent presence was noted in the text by Le Vu Khoi (1995) but the site is not in the accompanying tabulated national figures, nor was the species was listed in the comprehensive study of Chu Mom Ray NR by Do Tuoc and Ngo Tu (1995). Dao Van Tien and Tran Hong Viet (1984) listed no specimens from the area; the only indication they traced of its presence was Dang Huy Huynh *et al.* (1979), who listed it on the basis of interviews and / or old documents for the district (particularly around the Mo and Duc streams) and the adjacent one of Dak To. Tran Hong Viet (1988) listed it for total protection in the district, but later (1990) did not admit it to the mammal species of the province; perhaps the earlier listing was precautionary. Le Vu Khoi (*in litt.* to Hedges in prep.) stated that Banteng were most unlikely to occur in Chu Mom Ray.

Site: 44, **Chu Prong** District, Gia Lai Province

Locator: ca. 13°25'N, 107°45'E

Tiger Conservation Unit No: 113

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reports from locals were received by Do Tuoc and Le Trong Trai (in prep.), but they stressed that they need confirmation; area abuts Ea Sup (q.v.).

Status and conservation of very large mammals in Indochina

Site: 46, **A Yun Pa** (= Ajun Ba, Iajunba, A Yunba) District, Gia Lai Province

Locator: ca. 13°20'N, 108°30'E

Tiger Conservation Unit No: 117

Protection status: none traced

Level of evidence: extinct?

Class of evidence: not specified

Last positive information: unknown

Notes. A 1997 estimate of 20-25 in a widely circulated draft of Do Tuoc and Le Trong Trai (in prep.) actually referred to Ea So (q.v.) (Do Tuoc verbally 1998). The area may formerly (around 1980) have held the species but is now heavily disturbed (Do Tuoc verbally 1998); it is a new economic zone (Le Trong Trai verbally 1998).

Site: 47, **Ea Sup** District, Dak Lak Province

Locator: 13°00-20'N, 107°35'-108°00'E

Tiger Conservation Unit No: 113

Protection status: proposed National Park extension

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1997

Notes. See Yok Don NP for density information: from 1986-1987 (Dang Zui Khun *et al.* 1991). A total of 70-90 was estimated by local people in 1995, making it the most important area nationally for the species (Le Vu Khoi 1995), but Le Trong Trai (1993) received reports of only 33 animals, in five herds, including those in today's Ban Don District. In 1997, fresh footprints were found over wide areas of the logging concessions in the north and south; four were estimated to have been killed by soldiers in the area in 1996-1997 (Le Xuan Canh *et al.* 1997b). Dak Lak province as a whole was estimated to contain 15-130 in 1997 by Do Tuoc and Le Trong Trai (in prep.).

Site: 48, **Yok Don**, Ban Don District, Dak Lak Province

Locator: 12°45'-13°00'N, 107°29-50'E

Tiger Conservation Unit No: 113

Protection status: National Park

Level of evidence: confirmed

Class of evidence: seen etc.

Last positive information: 1997

Notes. Groups of 40 were seen in December 1986 and December 1987 in the Dak Nar / Dak Nor area; one specimen was taken and is now housed in the Hanoi University Collection (Le Vu Khoi verbally 1998); these are apparently the same records as the three groups reported to Hedges (in prep.) for March-April 1987. The density estimated from work in the Srepok basin (thus, some in Ea Sup) in 1986-1987 was of 551±147 in 612.5 sq. km (Dang Zui Khun *et al.* 1991). Based on data collected in 1986-1990, Dang Huy Huynh and Tran Anh Tuan (1991) calculated that 352 Banteng ±54 lived in the 580 sq. km of the park, but there is no indication as to how some figures used in its computation were derived. In April 1989 fresh signs were abundant, particularly in the west and around Yok Don hill, and animals were seen four times (a lone female, two males with nine females and three young, and at least 20 respectively) in the west of the reserve (Laurie *et al.* 1989). Fresh signs were found in October 1990 (Cox and Ha Dinh Duc 1990). In early 1995, three groups were seen, to the south and to the west of Yok Don hill and south of Yok Da; the biggest group was about 30. Signs were abundant. A group was also seen in late 1995 or in 1996 (Dang Huy Huynh *et al.* 1995a, 1997; Le Xuan Canh verbally 1997). The population was estimated at 35-45 by local people in 1995 (Le Vu Khoi 1995, verbally 1998). In May-June 1997, old signs were widespread, but fresh signs were restricted to one area in the far west; all registrations were of groups, and most involved very small calves. The lack of direct sightings (compare with Laurie *et al.* 1989), the localisation of footprints, and information from village people all indicate that a major decline has occurred. Three were estimated to have been killed by soldiers in 1995-1996 (Le Xuan Canh *et al.* 1997b). The population was assessed as being one of four key ones by Do Tuoc and Le Trong Trai (in prep.).

Site: 49, **Krong Trai** (formerly Suoi Trai), Son Hoa District, Phu Yen Province

Locator: ca. 13°00'N, 108°45'E

Tiger Conservation Unit No: none

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Seven were estimated by local people in 1993; the population has recently declined (Le Vu Khoi 1995, verbally 1998). Local reports suggest that in 1990 the area supported three herds totalling 50 animals; by 1994 fewer than 10 were assessed to remain (Le Trong Trai 1994). In 1992 a herd of 25 head was reported to remain; in 1997 the numbers were guessed as 15-20, although the need for further information was stressed. The population was assessed as being one of four key ones by Do Tuoc and Le Trong Trai (in prep.).

Site: 50, **Song Hinh** District, Phu Yen Province

Locator: ca. 12°55'N, 108°55'E

Tiger Conservation Unit No: none

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Local reports but no detail (Le Trong Trai 1994).

Site: 51, **Ea So** Commune, Ea Kar District, Dak Lak Province

Locator: 12°49'-13°01'N, 108°31'-44'E

Tiger Conservation Unit No: 118?

Protection status: proposed Nature Reserve

Level of evidence: confirmed

Class of evidence: seen, etc.

Last positive information: 1998

Notes. Fresh footprints were found regularly during April-May 1997 over most of the area surveyed; old footprints were found in an additional area where many people had settled in the preceding few months. A total of 17 animals were seen on 18 April, with five in the same area the next day. A group of soldiers videotaped a group of 12 three days later 4 km to the southeast. It is likely that the same herd was involved and indeed it is possible all signs in the area were left by one group. At least two were shot in the area in 1995-1996 (Le Xuan Canh *et al.* 1997b). A herd of at least ten was seen in the west of the area in February 1998 (J. Eames verbally 1998).

Site: 53, **Dak Mil** (= Dak Min) District, Dak Lak Province

Locator: 12°15'-12°45'N, 107°15'-108°00'E

Tiger Conservation Unit No: 113

Protection status: includes one Nature Reserve

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: unknown

Notes. A recent decline was noted for the area by Le Vu Khoi (1995), and only five animals were reported to Le Trong Trai (1993), with a further 12 in the recently-separated Cu Jut District. Le Xuan Canh (verbally 1997) found footprints and received reports from border guards (year not specified).

Site: 57, **Dak R'Lap** District, Dak Lak Province

Locator: ca. 12°10'N, 107°30'E

Tiger Conservation Unit No: 113

Protection status: includes one Nature Reserve

Level of evidence: provisional

Status and conservation of very large mammals in Indochina

Class of evidence: report

Last positive information: unknown

Notes. Two herds totalling eight animals were reported to Le Trong Trai (1993).

Site: 58, **Bu Gia Map**, Phuoc Long District, Binh Phuoc Province

Locator: ca. 12°09'N, 107°08'E

Tiger Conservation Unit No: 113

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. Recent presence was noted by Le Vu Khoi (1995) but the site is not in the tabulated national figures; Do Tuoc (verbally 1998) doubts that Banteng would occur in large numbers if at all as the habitat is not ideal.

Site: 59, **Bi Doup Nui Ba** (formerly Thuong Da Nhim), Lac Duong District, Lam Dong Province

Locator: ca. 12°04'N, 108°14'E

Tiger Conservation Unit No: 120

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. 25 were estimated by local people in 1990 (Le Vu Khoi 1995, verbally 1998), but recent surveys have recorded only Gaur (q.v.); perhaps the number is mis-aligned in the table.

Site: 60, **Dak Nong** District, Dak Lak Province

Locator: ca. 12°00'N, 107°45'E

Tiger Conservation Unit No: 113

Protection status: none traced

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. Listed for the area by Dang Huy Huynh *et al.* (1980).

Site: 61, **Ninh Son** District, Ninh Thuan Province

Locator: ca. 12°00'N, 108°40'E

Tiger Conservation Unit No: none; adjacent to 120

Protection status: none traced

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1997

Notes. In 1997, footprints were found of 1-2 small herds very close to a major road (Do Tuoc verbally 1998); the population was assessed as numbering 40-45 and to be one of four key ones nationally by Do Tuoc and Le Trong Trai (in prep.).

Site: 63, **Duc Trong** District, Lam Dong Province

Locator: ca. 11°35'N, 108°25'E

Tiger Conservation Unit No: 120

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Small numbers were reported in Dang Huy Huynh *et al.* (1982).

Site: 64, **Cat Loc**, Cat Tien / Bao Loc Districts, Lam Dong Province

Locator: ca. 11°36'N, 107°17'E

Tiger Conservation Unit No: 120

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. Listed as present by Sugardjito *et al.* (1993), and reported still to occur in the district by Le Vu Khoi (1995), but no detail given.

Site: 65, **Cat Tien**, Tan Phu / Bu Dang / Cat Tien Districts, Dong Nai / Binh Phuoc Provinces

Locator: 11°21-34'N, 107°11-28'E

Tiger Conservation Unit No: 120

Protection status: National Park

Level of evidence: confirmed

Class of evidence: report, footprints

Last positive information: 1998

Notes. A skull was purchased from a hunter in 1978; its location now is not known (Do Tuoc verbally 1998). Tracks of a herd of about 20 were found in the centre of the park in February-March 1992 (Dawson *et al.* 1993; Do Tuoc verbally 1998). In 1997, the population was assessed as being one of four key ones in Vietnam (Do Tuoc and Le Trong Trai in prep.). In early 1998, J. C. Eames (verbally 1998) spoke with a park guard who had seen one very clearly and recently.

Site: 69, **Di Linh** District, Lam Dong Province

Locator: ca. 11°25'N, 108°05'E

Tiger Conservation Unit No: 120

Protection status: none traced

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Small numbers were reported in Dang Huy Huynh *et al.* (1982). Two specimens at the Da Lat Biological Sub-institute probably came from the province (Pham Trong Anh *et al.* 1996).

Site: 71, **Bien Lac-Nui Ong**, Tanh Linh District, Binh Thuan Province

Locator: ca. 11°00'N, 107°03'E

Tiger Conservation Unit No: 120

Protection status: Nature Reserve

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Locals reported that in 1990 the area was home to 3-4 groups of 30-35 wild cattle (per Do Tuoc); by 1994 only ten remained (not identified to species), mainly around the Song Pan river (Le Trong Trai 1994).

Lao

Site: 80, **Phou Dendin**

Locator: 21°40'-22°18'N, 102°00'-40'E

Tiger Conservation Unit No: none

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Respondents in three of six villages questioned during 1989-1993 reported the species from their area (Salter 1993a). Reported in 1995 by residents of Muong Hat Hin and Ban Sop Kang (Robichaud and Sounthala 1995).

Site: 86, **Houay Nam Loy**

Locator: ca. 21°00'N, 100°50'E

Tiger Conservation Unit No: none

Protection status: former proposed protected area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Respondents in four of five villages questioned during 1989-1993 reported the species (Salter 1993a).

Site: 89, **Nam Ha** (East and West)

Locator: 20°32'-21°03'N, 100°52'-101°28'E

Tiger Conservation Unit No: 80

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Respondents in four of 11 villages questioned during 1989-1993 reported the species from their area (Salter 1993a). Reported from the Nam Fa area (Nam Ha West) and the Nam Oun area (Nam Ha East) by Phiapalath (1996); these records were doubted on the grounds of unsuitability of habitat by Tizard *et al.* (1997).

Site: 90, **Nam Kan**

Locator: 20°20'-46'N, 100°38'-54'E

Tiger Conservation Unit No: none

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Villagers report about 12 wild cattle. Identification in unclear, but the name "Kating deng" is used, suggesting Banteng (J.-F. Reumaux verbally 1998). As villagers do not mention two forms of cattle from the area, yet the habitat (hilly terrain at 500-1500 m, largely of evergreen and some mixed deciduous forest) appears more suitable for Gaur, further investigation is desirable. Berkmüller *et al.* (1995a) listed only Gaur on the basis of village interviews.

Site: 92, **Nam Et**

Locator: 20°09'-50'N, 103°21'-53'E

Tiger Conservation Unit No: none

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Respondents in three of six villages questioned during February 1993 reported the species from their area (Salter 1993a). Further reports were gathered in early 1998; the cattle were reported to be reddish with large white rump patches and to visit Phou Fa during July and August (Davidson in press).

Site: 93, **Phou Loey**

Locator: 19°50'-20°29'N, 103°00'-23'E

Tiger Conservation Unit No: none

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Respondents in four of 20 villages questioned during 1989-1993 reported the species from their area (Salter 1993a).

Site: 94, **Nam Xam**

Locator: 20°02'-14'N, 104°18'-53'E

Tiger Conservation Unit No: 95

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Respondents in seven of 11 villages questioned during 1989-1993 reported the species from their area (Salter 1993a). McNeely (1975) stated that a concentration occurred north of Xam-nua, although later (Lekagul and McNeely 1977) mapped the distribution as south of Xam-nua; Thornback (1984), apparently citing McNeely (1975), also noted them as south of Xam-nua.

Site: 95, **Louangphabang range**

Locator: unclear; ca. 20°N

Tiger Conservation Unit No: 82?

Protection status: none

Level of evidence: provisional

Class of evidence: not specified

Last positive information: unknown

Notes. McNeely (1975) stated that a concentration remained here in the mid 1970s.

Site: 105, **Vienthong** District, Bolikhamxai Province

Locator: 18°30'N, 104°45'E

Tiger Conservation Unit No: 99

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. The interpreter in January 1998 took considerable care to clarify that two types of wild cattle were present in the lower-lying area east of Phou Kadeung, and that one had reddish pelage; dates of sightings were not established (W. G. Robichaud verbally 1998).

Site: 106, **Nam Phoun** (= Pou)

Locator: 18°12'-47'N, 101°04'-29'E

Tiger Conservation Unit No: 81

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Status and conservation of very large mammals in Indochina

Notes. Respondents in five of 16 villages questioned during 1989-1993 reported the species from their area (Salter 1993a), but surveys in 1997 and 1998 found no evidence of the species in what seems atypical habitat (Boonratana 1997, 1998b).

Site: 107, **Pa Sak Xaignabouli**

Locator: ca. 18°30'N, 101°45'E

Tiger Conservation Unit No: none

Protection status: former proposed protected area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Respondents in three of nine villages questioned during 1989-1993 reported the species (Salter 1993a).

Site: 109, **Phou Khaokhoay**

Locator: 18°14'-34'N, 102°44'-103°29'E

Tiger Conservation Unit No: 98

Protection status: National Biodiversity Conservation Area

Level of evidence: extinct?

Class of evidence: report

Last positive information: unknown

Notes. Reported during village interviews in 1988-1989 (Salter and Phanthavong 1990), by respondents in five of 16 villages questioned during 1989-1993 (Salter 1993a) and from one man in 1994 (who reported a 1989 sighting near Pa Jong; Payne *et al.* 1995) but no evidence was found of the persistence of any wild cattle during 1996-1997 (J. Parr verbally 1998).

Site: 111, **Phuang District**, Vientiane Province

Locator: ca. 18°15'N, 101°40'E

Tiger Conservation Unit No: none

Protection status: none known

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. A small herd (5-7 animals) was reported to be present in mid 1998 but poaching pressure was reportedly intense (C. Inthavong verbally 1998).

Site: 112, **Nam Kading**

Locator: 18°11'-39'N, 103°54'-104°44'E

Tiger Conservation Unit No: 99

Protection status: National Biodiversity Conservation Area

Level of evidence: extinct?

Class of evidence: report

Last positive information: 1962

Notes. An old bull Banteng was killed near to salticks in the area between the NBCA and Ban Phonsi, in June 1962; one had earlier been fired upon in the area. This was reported as the first Lao record north of 16°N (Brix and Deuve 1963). Respondents in one of two villages questioned during 1989-1993 reported the species from their area (Salter 1993a), but there has been no subsequent evidence.

Site: 116, **Nakai Plateau**

Locator: 17°36'-18°00'N, 104°52'-105°32'E

Tiger Conservation Unit No: 99

Protection status: part National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: remains in village, footprints

Last positive information: 1995

Notes. Respondents in seven of 42 villages (some elsewhere in the NBCA) questioned during 1989-1993 reported the species from their area (Salter 1993a). Interviews in 1994 concluded that Banteng may well have been extirpated from the Plateau, although it was clear that they had occurred formerly. Footprints resembling in shape those of Banteng were however found near the Nam Xot in 1994 (WCS 1995c). An old hunter from Ban Don described the two species of wild cattle in detail and claimed that a very few Banteng remained on the plateau (Timmins and Evans 1996); some old signs to the north and south of the Nam On found in 1995 did indeed resemble this species in shape (WCS 1995c). There were several recent reports of this species from the Nam Nyalong area in 1995, and a skin identified as that of a young Banteng (although the distinguishing features of it, as distinct from a young Gaur, which is also reddish-brown, are not given) seen in Ban Lak (20) in 1995 was claimed to be from the western area of the plateau (WCS 1995c). Interviews in 1997 gathered no reports indicating continued presence (Tobias 1997). Historically Banteng occurred in this area (Legendre 1932) but it seems unlikely that viable numbers survive.

Site: 118, **Khammouan Limestone**

Locator: 17°26'-18°05'N, 104°25'-105°10'E

Tiger Conservation Unit No: 99

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Respondents in only one of 14 villages questioned during 1989-1993 reported the species from their area (Salter 1993a). The species was reported as extinct at four of 12 villages in early 1998; it was reported to live on Phou Ak until 20-30 years ago (Steinmetz 1998b).

Site: 119, **Hin Namno**

Locator: 17°15'-40'N, 105°43'-106°09'E

Tiger Conservation Unit No: 99

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. One credible informant reported in 1998 that one herd of 7-9 remained in one area to the south of the NBCA; he had last seen them in 1996 or 1997 (J. Walston and K. Khounboline verbally 1998).

Site: 121, **Phou Xang He**

Locator: 16°42'-17°04'N, 105°19'-106°06'E

Tiger Conservation Unit No: 99

Protection status: National Biodiversity Conservation Area

Level of evidence: extinct?

Class of evidence: report

Last positive information: unknown

Notes. Respondents in nine of 18 villages questioned during 1989-1993 reported the species from their area (Salter 1993a). It seems likely that the species did inhabit the area, as a pair of horns was observed in Ban Nahang Noi in early 1998, but no reports of sightings could be traced from after about 1990 (Boonratana 1998b). Note that the indication of presence in Duckworth et al. (1994: Table 1) was a typographical error.

Site: 122, **Dong Phou Vieng**, Savannakhet Province

Locator: ca. 16°26'N, 106°58'E

Tiger Conservation Unit No: none

Protection status: National Biodiversity Conservation Area

Status and conservation of very large mammals in Indochina

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. In April-June 1997, Banteng were reported to be largely extirpated from the NBCA. However, habitat in parts of the Phou Lapeung sector which were not visited, seems suitable for the species (Steinmetz 1998a).

Site: 123, **Xe Sap**

Locator: 15°56'-16°19'N, 106°41'-107°28'E

Tiger Conservation Unit No: 106 / 107

Protection status: National Biodiversity Conservation Area

Level of evidence: extinct?

Class of evidence: report

Last positive information: unknown

Notes. In 1997, Banteng were reported to be absent from the centre and north of the area, and to have been extirpated from the southwest in the 1970s (R. Steinmetz *in litt.* 1998).

Site: 126, **Xe Bang-Nouan**

Locator: 15°44'-16°01'N, 105°53'-106°18'E

Tiger Conservation Unit No: 104

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported from 16 of 28 villages around the NBCA in 1989-1993 (Salter *et al.* 1990, Salter 1993a). Villagers' reports, apparently from 1992, listed in Berk Müller *et al.* (1995a) were not confirmed by the survey of Timmins and Bleisch (1995).

Site: 127, **Phou Xiang Thong**

Locator: 15°19'-56'N, 105°25'-47'E

Tiger Conservation Unit No: 122

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints, report

Last positive information: 1998

Notes. Respondents in four of eight villages questioned during 1989-1993 reported the species from their area (Salter 1993a). In early 1996, fresh footprints clearly from wild cattle were widespread in the Houay Vangmoun catchment (at least one young animal) and old prints probably from wild cattle were widespread in the Houay Phalaphang catchment (again with young); shape suggested Banteng. [A provisional identification from the Hong Tat catchment has since been retracted; T. D. Evans *in litt.* 1998]. A saltlick at Bong Itao was reported to be used by the wet season and seven were said to have been shot there during 1995. Records cluster to suggest two separate populations, in the north and the south of the NBCA; other unsurveyed areas may support additional animals (Evans *et al.* 1996a). In late 1997, cattle tracks and dung were numerous on the Ban Xaimon-Ban Khamteu trail, particularly on rocky savannah flats, but as domestic cattle are pastured in the area and their footprints are difficult to distinguish from those of Banteng, these were dismissed. Prints found deep in forest and several km from the main trail (close to the southern population of Evans *et al.* 1996a) were felt "to possibly be those made by Banteng" (Boonratana 1998a). Residents of a village to the northeast of the reserve, near a saltlick used by wild cattle, were found guilty of three separate incidents of Banteng poaching in 1996-1998 (T. D. Evans verbally 1998).

Site: 129, **South of the Xe Don**

Locator: 15°35'N, 106°20'E

Tiger Conservation Unit No: 109

Protection status: none
Level of evidence: provisional
Class of evidence: report
Last positive information: unknown
Notes. Reported from some villages in 1988-1990 (Salter *et al.* 1990).

Site: 130, **Phou Theung**

Locator: 15°25-54'N, 106°29-51'E
Tiger Conservation Unit No: none
Protection status: proposed National Biodiversity Conservation Area
Level of evidence: provisional
Class of evidence: report
Last positive information: unknown
Notes. Reported by local people (Berkmüller *et al.* 1995a).

Site: 131, **Tha Teng**

Locator: 15°25'N, 106°20'E
Tiger Conservation Unit No: 108
Protection status: former proposed protected area
Level of evidence: provisional
Class of evidence: report
Last positive information: unknown
Notes. Respondents in one of three villages questioned in this area during 1989-1993 reported the species from their area (Salter 1993a).

Site: 133, **Phou Ilang**

Locator: ca. 15°00'N, 105°40'E
Tiger Conservation Unit No: 122
Protection status: former proposed protected area
Level of evidence: confirmed
Class of evidence: report, remains in village
Last positive information: unknown
Notes. Reported from many villages in 1988-1990 in and south of the hill (Salter *et al.* 1990). Unaged trophies were found in Ban Nonpachao and villagers reported that the species was still present in 1991 (Cox *et al.* 1992a).

Site: 134, **Bolaven Northeast** (= Phou Kateup)

Locator: 15°00-24'N, 106°23-49'E
Tiger Conservation Unit No: 108
Protection status: proposed National Biodiversity Conservation Area
Level of evidence: provisional
Class of evidence: report
Last positive information: unknown
Notes. Reported from villages around the area in 1988-1990 (Salter *et al.* 1990). Village reports (Berkmüller *et al.* 1995a), but not found in the southern parts of this area by WCS (1995d).

Site: 135, **Bolaven Southwest** (= Phou Luang)

Locator: 14°42'-15°06'N, 106°21-39'E
Tiger Conservation Unit No: 113
Protection status: proposed National Biodiversity Conservation Area
Level of evidence: provisional
Class of evidence: report
Last positive information: unknown
Notes. Reported from many villages around the area in 1988-1990 (Salter *et al.* 1990). A few

Status and conservation of very large mammals in Indochina

scattered reports in 1995 lacked details and seemed to refer to small numbers, in general suggesting a sparse population restricted to the remotest areas (WCS 1995d).

Site: 136, **Xe Khampho**

Locator: 14°35'-15°00'N, 106°11'-35'E

Tiger Conservation Unit No: 113

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1991

Notes. Reported from many villages in and around the area in 1988-1990 (Salter *et al.* 1990). Fresh footprints were found in April / May 1991 in the unprotected section of the Xe Kong plains to the east of the river (Cox *et al.* 1992a). Reported during some of 19 village interviews (Berkmüller *et al.* 1995a) and reported again in December 1997 (Salter *et al.* 1990; W. G. Robichaud verbally 1998).

Site: 137, **Phou Kathong**

Locator: 14°54'-15°19'N, 106°47'-107°14'E

Tiger Conservation Unit No: none

Protection status: proposed National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported from some villages around the area in 1988-1990 (Salter *et al.* 1990) and again reported on basis of village interviews by Berkmüller *et al.* (1995a); Davidson *et al.* (1997) received reports from villagers in this region (see Dong Ampham NBCA).

Site: 138, **Dong Ampham**

Locator: 14°38'-15°18'N, 107°08'-39'E

Tiger Conservation Unit No: 113

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported from one of two villages around the NBCA in 1989-1993 (Salter *et al.* 1990, Salter 1993a) and reported in January and April-May 1997 to be rare in the Xe Xou sector; no signs were found (Davidson *et al.* 1997). Several decades ago herds mixed with Kouprey lived on the Attapu plain (Salter *et al.* 1990).

Site: 139, **Nam Ghong**

Locator: ca. 14°30'N, 107°00'E

Tiger Conservation Unit No: 113

Protection status: Provincial Protected Area; former proposed protected area

Level of evidence: provisional

Class of evidence: footprints

Last positive information: 1998?

Notes. Tracks were found in several areas in early 1998, all from the previous wet season; signs were from a more restricted area than from those of Gaur and identification was not confirmed (Fernando in prep.; R. J. Tizard *in litt.* 1998).

Site: 140, **Dong Hua Sao**

Locator: 14°50'-15°11'N, 105°55'-106°18'E

Tiger Conservation Unit No: 113

Protection status: National Biodiversity Conservation Area

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported from four of 11 villages in and around the NBCA, and many to the south and west, in 1989-1993 (Salter *et al.* 1990, Salter 1993a).

Site: 141, **Xe Pian**

Locator: 13°55'-14°47'N, 105°54'-106°29'E

Tiger Conservation Unit No: 113

Protection status: National Biodiversity Conservation Area

Level of evidence: confirmed

Class of evidence: seen, remains in village etc.

Last positive information: 1997

Notes. Reported from all 11 villages where interviews were held in and around the NBCA, and from many to the north of the NBCA in 1989-1993 (Salter *et al.* 1990, Salter 1993a). Fresh footprints were found on the Xe Kong plains and a herd of at least six was seen east of the inflow of the Xe Pian river in April / May 1991. Recent tracks were found thrice near the Houay Kiang (Dong Kalo) in May 1991 and (twice) near the Houay Lekfai (Dong Kalo) in May-June 1992; remains of a young female were seen at a hunting camp near the Cambodian border in 1992 (Cox *et al.* 1992a). Several sets of prints were found in Dong Kalo, north of the Houay Kiang in early 1993 (Duckworth *et al.* 1994). Locals reported in 1997 that they moved between Dong Kalo and Cambodia and that although hunting levels were generally low, one was killed near Ban Phonvisai in 1994 or 1995. Signs were found in Dong Kalo, at similar abundance to Gaur, but not elsewhere within the reserve, although there were some local reports from the Xe Kong Plains (WWF / Burapha 1997). The species was again reported to persist on the Xe Kong plains in 1997 by residents of Ban Sompoy, within the Xe Khampho proposed NBCA (W. G. Robichaud verbally 1998).

Site: 142, **Dong Khanthung**

Locator: 14°07'-32'N, 105°12'-45'E

Tiger Conservation Unit No: 122

Protection status: proposed National Biodiversity Conservation Area; currently Protection Forest in some areas, provincial Conservation Forest in others, and unprotected elsewhere.

Level of evidence: confirmed

Class of evidence: seen etc.

Last positive information: 1997

Notes. Reported from a few villages in 1988-1990 (Salter *et al.* 1990). Reported in April 1996 by all but the two northernmost villages interviewed; four herds each of 10-20 animals reported near Houay Kamphot (4 km west of Ban Khem) with more in the border area; several herds of up to 10 reported in the Houay Man Kaew area east of Ban Don; location reports at other villages were more vague, and these two villages were felt to report the majority of the local Banteng population (Berkmüller and Vilawong 1996). Many old tracks resembling this species were found in the Nong Laha area in 1996 (Timmins and Vongkhamheng 1996b). One was seen at a saltlick west of Ban Tahin on 17 August 1996 from the air and fresh tracks of 2-3 animals were found south of Ban Pho (ICF 1996). In 1997, fresh tracks and dung were found near the Cambodia border on 28 March, older tracks were found in most areas of the southern dry dipterocarp / grassland areas and two herds totalling 20-25 were reported by army patrols on 30-31 March along the Houay Khamphot (Wolstencroft in prep.). Old tracks were seen at many localities in the southwest of the area in early 1998, with a notable concentration of fresh tracks around Ban Khem and the larger permanent water-bodies thereabouts. Old tracks were also found in the southeast. Villagers from Bans Houayxai, Kadian and Kadan all indicated that Banteng did not occur in their areas (Round and Vongkhamheng 1998).

Site: 143, **far southern Champasak**

Locator: 13°55'-14°05'N, 105°55'-106°10'E

Tiger Conservation Unit No: 113

Protection status: none

Status and conservation of very large mammals in Indochina

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported from a few villages in 1988-1990 (Salter *et al.* 1990).

Cambodia

Site: 150, **Virachey**

Locator: ca. 14°30'N, 107°10'E

Tiger Conservation Unit No: 113

Protection status: National Park

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported for the park in Chay Samith *et al.* (1995) and as "commonly" hunted in Robinson and Yem Sokhan (1996). Further reports of hunting were gathered in 1996 by Desai and Lic Vuthy (1996). The presence of large numbers or a widespread distribution was doubted by Weiler (1998a) as hunters were adamant that the species did not occur in the mountains as the forest was unsuitable, although the species might occur in the Tapok river plain, north of the Sesan river. On 1 April 1998, a herd of 7-11 (including two calves) were seen near map co-ordinates 48PYA400657, about 500 m from the park boundary in the unofficial buffer zone (E. Wikramanayake *in litt.* 1998). Good numbers may persist in the Taveng sector (Heng Kimchhay *et al.* 1998).

Site: 152, **Phnom Voene**, Ratanakiri Province

Locator: ca. 14°00'N, 106°45'E

Tiger Conservation Unit No: 113

Protection status: none

Level of evidence: confirmed

Class of evidence: remains in village

Last positive information: 1998

Notes. Footprints were seen in several meadows in early 1998 and a three sets of horns, at least one in Pakalan village, were inspected. Locals estimated that they shot about ten wild cattle per year in the area (Weiler 1998b).

Site: 153, **O'Chum** District, Ratanakiri

Locator: ca. 14°00'N, 107°15'E

Tiger Conservation Unit No: 113

Protection status: none

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Locally reported to occur in the O'Tret forest (Bann 1997). Based on the interview results summarised in Heng Kimchhay *et al.* (1998), it seems unlikely that this area supports sizeable numbers of the species.

Site: 156, **North and west of Ban Lung**, Ratanakiri Province

Locator: 13°39-54'N, 106°43-51'E

Tiger Conservation Unit No: 113

Protection status: none

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1996

Notes. Only three sets of fresh tracks (two singles and a group) were found along the 99 km walked in May-June 1996, indicating a very low population (Desai and Lic Vuthy 1996). Based on the interview results summarised in Heng Kimchhay *et al.* (1998), it seems unlikely that this area still supports the species regularly.

Site: 158, **Kulen-Promtep**, Siem Reap Province

Locator: ca. 14°05'N, 104°30'E

Tiger Conservation Unit No: 122

Status and conservation of very large mammals in Indochina

Protection status: Wildlife Sanctuary

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Thornback (1984), citing either McNeely (1975) or B. Lekagul (*in litt.* 1983) stated that some remained in this area, and in the nearby Angkor area, in the mid 1970s. A herd of five was reported from the general area by the provincial forest department in 1997. Lao reportedly come across and hunt within Cambodia (Sun Hean verbally 1998) and the WS in fact appears to retain few very large mammals (Heng Kimchhay *et al.* 1998).

Site: 159, **Phnom Kulen**, Siem Reap Province

Locator: ca. 13°40'N, 104°00'E

Tiger Conservation Unit No: 122

Protection status: National Park

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Thornback (1984), citing either McNeely (1975) or B. Lekagul (*in litt.* 1983) stated that some remained in this area, and in the nearby Angkor area, in the mid 1970s. Salter (1993b) received no reports, but more recently a herd of five was reported from the general area by the provincial forest department in 1997 (Sun Hean verbally 1998).

Site: 161, **Lomphat**

Locator: ca. 13°20'N, 107°10'E

Tiger Conservation Unit No: 113

Protection status: Wildlife Sanctuary

Level of evidence: confirmed

Class of evidence: seen

Last positive information: 1994

Notes. McNeely (1975) stated that a concentration remained to the south of the town. Two contacts, of seven animals and a single respectively, were made from the air in March 1994 just east of the protected area border and north of the Srepok (Olivier and Woodford 1994). The species was seen from the air in 1994 in or adjacent to the reserve (D. Ashwell verbally 1998); this probably refers to the unlocated sighting reported in Barzen (1994). Local reports that concentrations still occurred in 1996 were received by Desai and Lic Vuthy (1996). The area south of the Srepok is still reported to contain medium wildlife densities, but the part to the north apparently supports very few very large mammals (Heng Kimchhay *et al.* 1998).

Site: 162, **Roniem Daun Sam**

Locator: ca. 13°20'N, 102°10'E

Tiger Conservation Unit No: 124

Protection status: Wildlife Sanctuary

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Hunters' reports from the sanctuary and the surrounding general area gathered in 1998 (Heng Kimchhay *et al.* 1998).

Site: 164, **Northeast Mondulkiri** Province

Locator: ca. 13°05'N, 107°25'E

Tiger Conservation Unit No: 113

Protection status: none

Level of evidence: confirmed

Class of evidence: footprints

Last positive information: 1995

Notes. A small area of Mondulkiri with numerous fresh wild cattle footprints, dung and grazing signs in March-April 1994 was estimated to hold 40-50 Banteng; it appears some were observed directly. There were also many signs from the former wet season, demonstrating year-round presence (see Yok Don). An unspecified number of wild cattle carcasses were found which had had parts of their skulls removed (Dioli 1994). The area is believed to be to the west and south of the Srepok from the Vietnamese border. A total of 47 sets of footprints were found in 155 km of survey between Senmonorom and the Srepok river in June 1995 (Sun Hean 1995a). To the north of the Srepok recent reports of good numbers were gathered in 1998 (Heng Kimchhay *et al.* 1998).

Site: 165, **East Mondulkiri** Province

Locator: 12°33-59'N, 107°21-32'E

Tiger Conservation Unit No: 113

Protection status: none

Level of evidence: confirmed

Class of evidence: seen

Last positive information: 1996

Notes. Five herds of 7-14 were seen from the air in March 1994, excluding those listed under individual protected areas of Phnom Prich and Lomphat (Olivier and Woodford 1994). The species was widely recorded over the northern part of 223 km walked in April-May 1996 (roughly coinciding with the aerial survey area), but much less frequently so in the southern part, where human disturbance was higher (Desai and Lic Vuthy 1996).

Site: 166, **Phnom Prich**

Locator: ca. 12°30'N, 107°10'E

Tiger Conservation Unit No: 113

Protection status: Wildlife Sanctuary

Level of evidence: confirmed

Class of evidence: seen

Last positive information: 1994

Notes. Two herds, of 12 and 15 respectively, were seen in March 1994 (Olivier and Woodford 1994). Hunters' reports suggested that this part of Mondulkiri Province had the greatest numbers of large mammals (Heng Kimchhay *et al.* 1998).

Site: 168, **Phnom Nam Lyr**

Locator: ca. 12°20'N, 107°50'E

Tiger Conservation Unit No: 113

Protection status: Wildlife Sanctuary

Level of evidence: confirmed

Class of evidence: not specified

Last positive information: 1996

Notes. Occurs (Desai and Lic Vuthy 1996), as commonly as in the Phnom Yangke / Yang Por areas (Lic Vuthy *in litt.* 1998). Hunters' reports suggested that some numbers remain (Heng Kimchhay *et al.* 1998).

Site: 169, **Snoul**

Locator: ca. 11°50'N, 107°00'E

Tiger Conservation Unit No: 113

Protection status: Wildlife Sanctuary

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported as frequently seen by villagers (Nhie! Thorn and Be Seng Leang 1996). The small sector in Keo Sema District (Mondulkiri) and land outside the sanctuary to the east and north was

Status and conservation of very large mammals in Indochina

reported to be much richer than the majority of the sanctuary, in Kratie Province (Heng Kimchhay *et al.* 1998).

Site: 170, **Phnom Aural**

Locator: ca. 11°40'N, 104°05'E

Tiger Conservation Unit No: 125

Protection status: Wildlife Sanctuary

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Reported by local people and / or soldiers, but information needs checking (Chay Samith verbally 1998).

Site: 172, **Kirirom**

Locator: ca. 11°05'N, 104°00'E

Tiger Conservation Unit No: 125

Protection status: National Park

Level of evidence: provisional

Class of evidence: report

Last positive information: unknown

Notes. Numbers between 20 and 50 according to local soldiers questioned in May 1995 (Lay Khim and Taylor-Hunt 1995), but caution is needed as the soldiers were credited with several incorrect species identifications.

Site: 176, **Kom Mum**, Ratanakiri Province

Locator: ca. 13°30'N, 106°40'E

Tiger Conservation Unit No: 125

Protection status: none

Level of evidence: provisional

Class of evidence: footprints

Last positive information: 1998

Notes. Sets of old tracks provisionally identified as this species were found at two widely-separated localities in mid 1998. In view of the survey effort, it is clear that the area does not regularly hold the species (Timmins in prep.). Note: out of latitudinal sequence and not mapped as information freshly received after map produced.

Yunnan Province, China

Site: 189, **Zulin**, Simao Country

Locator: ca. 22°45'N, 100°30'E

Tiger Conservation Unit No: not applicable

Protection status: part Provincial Nature Reserve (1997 on)

Level of evidence: not applicable

Class of evidence: not applicable

Last positive information: 1987

Notes. About 1983 a young animal (about 1.1 m at the shoulder) was sent to the Kunming zoo by villagers. It was examined when dead and showed the characteristic white rump patch, as well as white stockings. The general body colour was a rufous brown, seeming to the observer to be less yellowish than are Banteng in Indonesia. The skin was retained by the zoo but has apparently now decayed. In 1987 or 1988 a joint team from the Beijing Natural History Museum and the Kunming Zoo returned to the area; two were killed, one of which was sent to Beijing, while the other appears to have been retained by local villagers. A primatological survey team reported further sightings from the area in 1994, leading to a visit by a graduate student of the Kunming Institute of Zoology later that year; the latter failed to observe the animals, but found many footprints. Local estimates indicate that fewer than 30 animals survive. The area is in the catchment of a small tributary of the Mekong at 600-1200 m altitude (to 2000 m in the area) and supports broad-leaved forest which is believed to be deciduous. The local government has taken the first steps in declaring the area a nature reserve (Wang Yingxiang verbally 1998).

ANNEX 5 : ADMINISTRATIVE PROVINCE LOCATION OF PROTECTED AREAS IN LAO AND CAMBODIA

Locality	Province
Lao	
National Biodiversity Conservation Areas	
Dong Amphani	Attapu
Dong Hua Sao	Champasak
Dong Phou Vieng	Savannakhet
Hin Namno	Khammouan
Khammouan Limestone	Khammouan
Nakay-Nam Theun	Khammouan, Bolikhamxai
Nam Et	Houaphanh
Nam Ha (East)	Louang-Namtha
Nam Kading	Bolikhamxai
Nam Phoun	Xaignabouli
Nam Xam	Houaphan
Phou Dendin	Phongsali
Phou Khaokhoay	Vientiane, Bolikhamxai
Phou Loeyuy	Houaphan, Louangphabang
Phou Phanang	Vientiane Prefecture / Province
Phou Xang He	Savannakhet
Phou Xiang Thong	Salavan
Xe Bang-Nouan	Savannakhet, Salavan
Xe Pian	Champasak, Attapu
Xe Sap	Salavan, Xekong
Proposed National Biodiversity Conservation Areas	
Bolaven Northeast	Champasak, Attapu
Bolaven Southwest	Champasak, Attapu
Dong Khanthung	Champasak
Nakay-Nam Theun Extension	Bolikhamxai
Nam Chouan	Khammouan, Xiangkhouang
Nam Ha (West)	Louang-Namtha
Nam Kan	Bokeo
Nam Theun Corridor	Khammouan, Bolikhamxai
Phou Kathong	Attapu, Xekong
Phou Theung	Salavan, Xekong
Xe Khampho	Champasak, Attapu
Major sites outside the NBCA system	
Nakay Plateau	Khammouan
Sangthong Training and Model Forest	Vientiane Prefecture
Cambodia	
National Parks	
Botum-Sakor	Koh Kong
Kep	Kampot
Kirirom	Kompong Speu / Koh Kong

Status and conservation of very large mammals in Indochina

Phnom Bokor	Kampot
Phnom Kulen	Siem Reap
Ream	Sihanoukville
Virachey	Ratanakiri
Wildlife Sanctuaries	
Beng Per	Kompong Thom
Kulen Promtep	Siem Reap, Preah Vihear
Lomphat	Ratanakiri, Mondulkiri
Aural	Koh Kong, Pursat, Kompong Chhnang
Peam Krasop	Koh Kong
Phnom Nam Lyr	Mondulkiri
Phnom Prich	Mondulkiri
Phnom Samkos	Koh Kong
Roniem Daun Sam	Battambang
Snoul	Kratie

Notes:

Protected Landscapes and Multiple-Use Management Areas also exist in Cambodia, but are not listed (none is discussed in the text)

Protected areas are not listed for Yunnan Province, China or Vietnam as no authoritative up-to-date source was traced. Furthermore, the protected area system in both is under review. Provinces are given for all Vietnamese protected areas in the text.

Protected areas are listed alphabetically for ease of reference.

ANNEX 6: SCIENTIFIC NAMES OF MAMMAL AND BIRD SPECIES MENTIONED IN THE TEXT

Mammals:

Francois's Langur *Trachypithecus francoisi* (including 'Golden-headed Langur' *T. (f.) poliocephalus*, 'Delacour's Langur' *T. (f.) delacouri* and 'Hatinh Langur' *T. (f.) hatinhensis*)
 Tonkin Snub-nosed Langur *Rhinopithecus avunculus* (Tonkin Snub-nosed Monkey)
 Asiatic Jackal *Canis aureus*
 Coyote *Canis latrans*
 Grey Wolf *Canis lupus*
 Dhole *Cuon alpinus* (Asian Wild Dog, Red Dog)
 Asian Black Bear *Ursus thibetanus*
 Sun Bear *Ursus malayanus*
 American Marten *Martes americana*
 Fisher *Martes pennanti*
 Bay Cat *Catopuma badia*
 Canada Lynx *Lynx canadensis*
 Leopard Cat *Prionailurus bengalensis*
 Puma *Puma concolor* (Mountain Lion, Cougar)
 Clouded Leopard *Pardofelis nebulosa*
 Jaguar *Panthera onca*
 Leopard *Panthera pardus*
 Tiger *Panthera tigris*
 Asian Elephant *Elephas maximus*
 African Elephant *Loxodonta africana*
 Asian Tapir *Tapirus indicus* (Malay Tapir)
 Javan Rhinoceros *Rhinoceros sondaicus* (Lesser Asian One-horned Rhinoceros)
 Sumatran Rhinoceros *Dicerorhinus sumatrensis* (Asian Two-horned Rhinoceros)
 Black Rhinoceros *Diceros bicornis*
 Indochinese Pig *Sus bucculentus* (Vietnamese Warty Pig)
 Lesser Mousedeer *Tragul javanicus* (Lesser Chevrotain)
 Greater Mousedeer *Tragulus napu* (Greater Chevrotain)
 White-tailed Deer *Odocoileus virginianus*
 Sambar *Cervus unicolor*
 Giant Muntjac *Megamuntiac vuquangensis*
 Roe Deer *Capreolus capreolus*
 Kouprey *Bos sauveli*
 Gaur *Bos gaurus*
 Banteng *Bos javanicus*
 Asian Buffalo *Bubalis arnee* (Wild Water Buffalo)
 Saola *Pseudoryx nghetinhensis*
 Khting Vor *Pseudonovibos spiralis* (there is as yet no standardised English name for this newly described species; as with Saola, direct adoption of a local name is appropriate)
 Snowshoe Hare *Lepus americanus*
 Black Giant Squirrel *Ratufa bicolor*
 Inornate Squirrel *Callosciurus inornatus*

Birds:

Vietnamese Pheasant *Lophura hatinhensis*

Status and conservation of very large mammals in Indochina

Imperial Pheasant *Lophura imperialis*

Brent Goose *Branta branta*

Spotted Owl *Strix occidentalis*

Sarus Crane *Grus antigone*

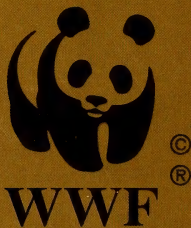
River Lapwing *Vanellus duvaucelii*

Grey-faced Tit Babbler *Macronous kelleyi*



WWF is the world's largest and most experienced independent conservation organisation, with 4.7 million supporters and a global network active in 96 countries. Since its inception in 1961, WWF has invested in over 12,600 conservation projects in 154 countries. Worldwide, WWF undertakes more than 1,200 projects every year.

The WWF Indochina Programme is active in Vietnam, Lao and Cambodia, supporting local conservation efforts for key species including the saola, tiger, Javan rhino and marine turtles. There are ongoing conservation projects in Vu Quang Nature Reserve and Cat Tien National Park in Vietnam, at Virachey National Park in Cambodia and at the Phong Nha-Ke Bang/Hin Namno transboundary limestone forest along the border between Lao and Vietnam.



WWF Indochina Programme
7 Yet Kieu Street
Hanoi, Vietnam